COMPENDIUM OF TECHNOLOGIES FOR APPLICATION IN RURAL AREAS

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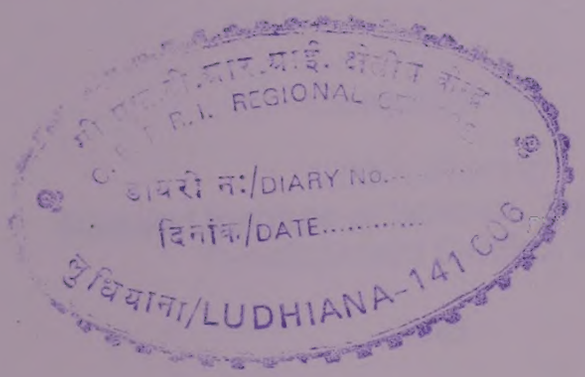
Compiled By
V.P.Kharbanda
and
J.S. Khan

COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH
NEW DELHI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COMPENDIUM OF TECHNOLOGIES FOR APPLICATION IN RURAL AREAS

Compiled By

V.P.Kharbanda
National Institute of Science, Technology and Development Studies, CSIR

and

Dr. J.S. Khan
Council of Scientific & Industrial Research

COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH
NEW DELHI
FEBRUARY 1990

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NATIONAL INSTITUTE OF SCIENCE, TECHNOLOGY
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NATIONAL INSTITUTE OF WASTELANDS AND RURAL DEVELOPMENT
(NIWARD) NEW DELHI

Cover Design
Pradip Banerjee

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Computer-aided Laser Output
National Institute of Science, Technology and Development Studies, New Delhi
Designed and Printed by the Publications & Information Directorate
New Delhi-110012.

FOREWORD

Since independence we have been striving towards a better life for our people particularly the rural population so that they are better fed, better clothed, better educated and have better living conditions. It is to meet these challenges that we have embarked on planned growth. Over the past decade, India has made steady progress in the task of rural reconstruction and rural development through successive five-year plans. Much has been achieved but more is still to be done.

The objective of rural development has been the promotion of all-round development of the rural masses economically as well as socially. The essential elements in rural development are the participation by the people themselves in an effort to improve their living conditions and the provision of technical and other information, in a way which would encourage initiative and self-help towards achieving better economic and social development.

There is a growing awareness on the part of the planners, researchers, administrators and agencies connected with developmental activities directly or indirectly for socio-economic development of rural population through the applications of science and technology. Over the years, a number of technologies have been developed in CSIR laboratories, agricultural universities and other institutions in the country for almost every sphere of activity in rural areas. Yet, not all the technologies have found application in the farthest corners of the country. Apparently, the problem lies not in generation of technologies but in diffusion and adoption of these technologies.

A number of agencies such as National Research Development Corporation (NRDC), Council for Advancement of People's Action and Rural Technology (CAPART), Khadi and Village Industries Commission (KVIC) have devoted their efforts to this cause. NRDC has set up 35 Rural Technology Demonstration-cum-Training (RTDT) Centres in different parts of the country in association with voluntary agencies/government organisations to bring about technology transfer with a multiplier effect. CAPART acts as a nodal point for dissemination of technologies relevant to rural areas and as a clearing house of information and as a data bank. The National Institute of Wastelands and Rural Development (NIWARD) is also involved in the diffusion and popularization of rural technologies. One of the strategies to achieve this objective is through organisation of S&T demonstration campaigns. One such campaign organised in March 1989 at Gauriganj, District Sultanpur, Uttar Pradesh, was a major success. It has been felt necessary to bring out a compendium of appropriate technologies available in the country for wide information dissemination, which could serve as a ready reference for entrepreneurs and others interested in relevant technologies for their adoption. This compendium is expected to fill this gap.

This compendium provides basic information at one place, on some of the relevant technologies/techniques which could be applied in rural areas. These were demonstrated at S&T Demonstration Campaign held at Gauriganj, District Sultanpur, Uttar Pradesh between March 4 and March 15, 1989.

I do hope the compendium would go a long way in helping the masses to adopt these technologies for a better life.

D.P. YADAV
Chairman
National Institute of Wastelands
and Rural Development, New Delhi

PREFACE

One of the major problems facing India is the impoverished socio-economic conditions of rural population. According to the survey conducted by the National Sample Survey Organisation, the majority of rural population still lives below the poverty line. The developmental plans of the country have, therefore, accorded high priority to removal of poverty and providing employment in rural areas. In the absence of established strategies to tackle these problems, a number of programmes have been devised over the years. Schemes such as the Integrated Rural Development Programme (IRDP), the National Rural Employment Programme (NREP), and the Rural Landless Labour Employment Guarantee Programme have been in operation for several years. In order to provide basic services and facilities essential for raising the living standards in rural areas, a 'Minimum Needs' programme has also been under implementation since 1975. This programme is aimed at providing primary and adult education, rural health services, nutrition, rural water supply, rural roads, rural electrification and rural housing. Several technological and societal missions have been launched with specific goals. The National Literacy Mission is aimed at imparting functional literacy to 80 million illiterates in the age group of 15-35 by 1995. The Technology Mission on Vaccination and Immunization aims to provide immunization services to 92 million pregnant women and 82 million infants by 1990. Drinking water supply to 86,000 problem villages is to be provided by 1990 under the Water Technology Mission. Many inputs based on S&T are necessary in these efforts.

National Laboratories of CSIR and other S&T institutions of the country have developed a number of techniques and technologies. These can be adopted by the masses for improvement in quality of life, employment generation and better utilization of natural resources of the country, including agricultural lands. The awareness among the masses about these techniques and technologies is limited. It is imperative to put in more effort in creating widespread awareness among the masses about these techniques and technologies and consequently hasten the process of assimilation by the masses. In order to achieve the above objectives, the following multi-pronged strategy has been adopted by CSIR:

- Providing S&T inputs in national missions;
- Organisation of S&T Demonstration-cum-Exhibition Campaigns in rural areas in collaboration with voluntary agencies;
- Extensive documentation of techniques and technologies developed by S&T institutions of the country in print and on video tapes and making these available to the masses and authorities involved in implementation of developmental programmes;
- Collaborative S&T programmes with State S&T Councils and other agencies such as KVIC engaged in rural development to introduce improved technologies for employment generation and harnessing local resources; and

- Creation of CSIR complexes and streamlining the functioning of Polytechnology Transfer Centres for effective extension.

In pursuance of the above strategy, a S&T Technology Demonstration Campaign was organised at Gauriganj, District Sultanpur, Uttar Pradesh from 4 to 15 March 1989. Major S&T institutions of the Central and State Governments, in addition to public and private sectors' organisations, participated in the Campaign. These institutions demonstrated a number of technologies through working models.

The present compendium is a compilation of the techniques and technologies demonstrated at Gauriganj. I believe that interest in science and technology can be created and sustained by relating its usefulness in everyday life. This correlation also enhances the possibility of their adoption by the masses. The technologies and techniques have, therefore, been classified into themes which are easily identified in everyday life. They are:

- Technologies for improvement in quality of life;
- Technologies for employment generation; and
- Technologies and practices for higher agricultural yield and income.

I am sure that the agencies and personnel engaged in developmental activities shall find this compendium useful.

RAM K. IYENGAR
Additional Director General
Council of Scientific and
Industrial Research,
New Delhi

INTRODUCTION

India continues to face poverty and unemployment as the major problems especially in the rural areas. The increase in population further aggravates these problems. Over the years, the government has been trying to improve the socio-economic conditions of the people by providing following infrastructural facilities and support services in the rural areas:

- Infrastructural facilities like roads, electricity, water supply and housing;
- Support services like education, nutrition, health care, family welfare, etc. and
- Employment opportunities in construction of infrastructural facilities, trading and business ventures including self - employment.

These facilities and services are provided under various programmes of the government formulated from time to time.

Pandit Jawaharlal Nehru placed great faith on the role of science and technology to accelerate the developmental activities of the nation. As a result, a number of S&T institutions have been established in the country. These institutions have developed many technologies which have tremendous potential of application in rural areas. The main advantages of such technologies are : simple principle of operation, use of local raw materials, manufacture of products having local/regional market, low maintenance and comparatively less investment levels required for adoption. These techniques and technologies are related to almost every activity of rural life, namely low-cost house building, waste-water disposal and sanitation, road-building, health care, food, usar land reclamation, agriculture and employment/income generation. Many organisations of the government like Khadi and Village Industries Commission (KVIC), Council for Advancement of People's Action and Rural Technology (CAPART), Department of Science and Technology (DST), National Research Development Corporation (NRDC), and Council of Scientific and Industrial Research (CSIR) support the generation and promotion of appropriate technologies under various schemes. In addition, engineering-based educational institutions, state government organisations, voluntary agencies and private establishments augment these efforts. The net result of these endeavours has been laudable but still a lot more needs to be done to bring prosperity to the people in the rural areas.

The major constraints in the application of scientific techniques and technologies relevant to rural areas are absence of suitable mechanisms and organizations for:

- Identification of the needs of rural population and their consequent communication to scientists of S&T organisations.
- Extension of scientific and technological options resulting therefrom to the villages.

As a consequence, the rural population and development administrators, by and large, are not aware of technological options available at S&T institutions and the benefits that can accrue from them.

On the other hand, in the absence of demand from people. Science and Technology in India has acquired more and more Western orientation over the years and this process continues.

Exhibition is a known technique of information dissemination about achievements in various fields of science and technology. An innovative idea of 'Demonstration Campaign' consisting of demonstrations of techniques/ technologies either live or through working models or video films, was considered to be more appropriate for rural areas to enhance acceptability and adoption of these technologies. The first Science & Technology Demonstration Campaign was organised at Gauriganj, Distt. Sultanpur, Uttar Pradesh, from 4th to 15th March 1989. The Campaign was focussed to create awareness about contributions of S&T organisations in the following streams of socio-economic development:

- Improvement in Quality of life;
- Employment Generation; and
- Higher Agricultural Yield and Increased Income

All major S&T institutions of the country, including state government, public and private sectors organisations, participated in this Campaign. The rural population responded to the campaign very enthusiastically. The people visited the campaign in large numbers and evinced keen interest in the technologies. The impact analysis carried out by Prof. Kanta Prasad, Indian Institute of Public Administration (IIPA), revealed that "80% of the people who visited this campaign considered it very useful for rural population; 12.67% did not express opinion while 7.5% had reservations about its usefulness."

It is imperative that specific projects and programmes for socio-economic development of target rural areas be formulated based on inputs by S&T organisations, by state/district development agencies. For preparation of such plans it is necessary that the technologies developed by S&T organisations be documented in the form of a handbook. The present compendium is an attempt in this direction. The compendium provides basic information about the techniques and technologies generated in S&T institutions to the people and administrators associated with developmental activities. The detailed descriptions and designs have been avoided to keep the text simple and comprehensible. Addresses of contact agencies have been given in case further details are needed.

We accept that the spectrum of technologies included in the compendium is not comprehensive and there may be many more which could have been included. We have tried to concentrate on technologies which were demonstrated at the S&T Demonstration Campaign organised at Gauriganj, Distt. Sultanpur, Uttar Pradesh.

We firmly believe that poverty and lack of awareness about appropriate technological options to combat poverty are the basic reasons for the state of underdevelopment prevailing in rural areas. The basic criterion for selection of technologies for this compendium is the potential to generate employment and to provide increased income to the people. The technologies included in the present volume, therefore, have two facets:

- These technologies could be adopted by people for benefit in their day-to-day life, e.g. high efficiency wood burning stoves could be used by people for conservation of fuel wood, improved conditions for cooking, etc.

The technologies/ products could be commercially manufactured by people to increase their income, e.g. people could take up manufacture of high efficiency wood burning stoves as industrial activity, thereby generating employment and increased income.

Another characteristic of majority of the technologies is that business ventures for manufacture of technologies or products thereform could be started at household, cottage and small scale levels with comparatively low investments.

A notable feature of most of the technologies is that manufacture of these is labour-intensive and can generate more employment as compared to the level of investments, if adopted as business activity.

We wish to emphasize again that generation of employment and increased income is the focal theme of the compendium in consonance with rising unemployment and perpetual poverty prevalent in the rural areas.

We sincerely hope that people, artisans, entrepreneurs and development administrators would find the compendium useful.

Dr. J.S.Khan **V.P. Kharbanda**

ACKNOWLEDGEMENT

This compendium of technologies for rural areas has been prepared under the guidance of Dr. Ram K. Iyengar, Additional Director General, *CSIR*. We are grateful to Dr.Ashok Jain, Director, *NISTADS* for extending facilities at NISTADS for completing this compendium. Thanks are due to Shri L.R. Dhawan for editing the manuscript, Mrs. Veena Kautilya and Shri Sudarshan Singh for typing the manuscript, and Ms. Shammi Gupta, Ms. Archana and Sh. Ajay Sheopuri for layout design and laser printout. We are also grateful to the Director and the Printing Unit of PID for printing this publication at a short notice.

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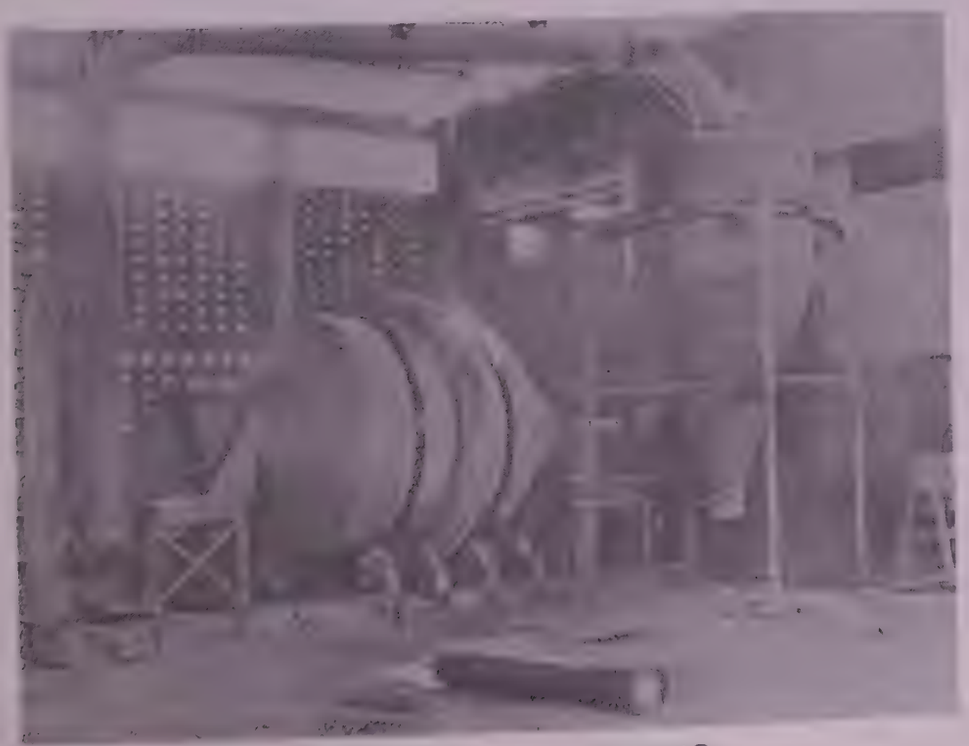
*Technologies marked with * could be taken up as independent business ventures for employment and income generation.*

I TECHNOLOGIES FOR IMPROVEMENT IN QUALITY OF LIFE

A. RURAL HABITAT AND INFRASTRUCTURE

ACTIVATED LIME-POZZOLANA MIXTURE

Lime, in conjunction with burnt clay - popularly known as surkhi - or cinder - known as lime - pozzolana mixture - has been used as a material of construction in the country since time immemorial. The mixture possesses good workability, high water retentivity and superior bond strength, and in addition, develops a high strength with the passage of time. In modern constructions, where time is the essence, these mixtures, because of their slow - setting and slow development of strength, have fallen out of use. To get round these difficulties, the Central Building Research Institute, Roorkee, has developed activated lime - pozzolana mixture(s) (ALPM) from locally available materials of numerous localities. The know-how for the manufacture of the mixture has been released to several entrepreneurs. The mixture sets faster - initial seting in 30 min. and final seting in 24 hours. It gains strength at a faster rate. It can carry a considerable amount of sand; as much as five times of its weight of sand can be mixed with it. It can also be converted into mortars for masonry and plaster directly by mixing with sand and water. No initial preparations like soaking, sieving or grinding are required.



PLANT FOR MANUFACTURING
ACTIVATED LIME POZZOLANA MIXTURE

COST The setting up of a plant requires a low capital of only Rs. 3.05 lakh with a working capital of Rs 2.0 lakh.

CONTACT AGENCY

The Director
Central Building Research Institute
Roorkee 247 667

Telephone	Telex	Telegram
2243	0597-203 CBRI IN	BILDSERCH,Roorkee

PREFAB BRICK PANELS FOR ROOFING

The system is based on the principle of prefabrication as applied to bricks. The reinforced roof panels are made at ground site by using 17 burnt bricks in 1:4 cement-coarse and sand-mortar or 16 burnt bricks in 1:2:4 cement concrete reinforced with 2 mild steel bars of 6 mm. The first is applicable to good-quality bricks with a crushing strength of 70 kg/cm sq. or more. The size of the panel is 560 x 1040 mm. These panels are supported on partially precast RCC joists and joined together in 1:4 cement-sand mortar. Reinforcement with 6 mm dia. bar, one on each panel both ways, is also provided. Over the panel slabs, a 30 cm thick cement concrete of grade M 150 is laid all over the roof. This is topped with a water-proofing layer. The system offers considerable saving in bricks (30-35%) as against 115 mm thick RB roof slabs. The unreinforced prefabricated brick panels can be used for walls also, in which case there is 60-70% reduction of bricks in walls as against a one-brick-thick wall.

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SEGMENTED FERROCEMENT ROOFING UNDER PREPARATION

FERROCEMENT ROOFING UNITS

A large number of low-cost houses and small buildings for schools, dispensaries and stores are required to be constructed in semi-urban and rural areas. Asbestos cement (A.C.) sheet roofs used at present get easily damaged during transportation, or construction or while in use.

To replace the conventional galvanized iron (G.I.) and A.C. sheet roofs, two types of ferrocement roofing units (folded plate roof and segmental shell roof) have been developed by the Structural Engineering Research Centre. The process being mechanical is quite suitable for commercial production. In case of accidental damage, ferrocement roofing can be repaired. The ferrocement roofing unit is more economical than A.C./G.I. sheet roof. This sheet does not require much maintenance.

COST The cost of construction for the trough-shaped folded plate roof and segmental shell roof comes to about Rs 100 per square metre.

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CLAY ROOFING MANGALORE-PATTERN TILES

CLAY ROOFING TILES

Mangalore-pattern clay roofing tiles, named after the place in Karnataka, are interlocking type with ribs and lugs to rest on battens. These tiles are extremely popular in the coastal states. Production of such tiles from alluvial soils had not been attempted because of their poor workability and silty nature. The Central Building Research Institute (CBRI), Roorkee, has, therefore, developed a process for the manufacture of such tiles from alluvial soils.

The tiles possess a uniform texture and colour, a metallic sound and a good finish. Tests carried out in accordance with IS specifications have shown that the breaking load is 110-190 kg for AA class and 90-110 kg for A class, while water absorption is 12-14 and 14-16% respectively.

COST Rs 675 per thousand of AA class tiles and Rs 600-650 per thousand of A class tiles, depending on the place.

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Roorkee 247 667 (U.P.)

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A FINISHED FLOOR WITH CLAY TILES; THESE HAVE LASTED 10 YEARS.

CLAY FLOORING TILES

Clay flooring tiles form one of the cheapest and most durable building materials in rural houses. Tiles conventionally manufactured in northern India from alluvial soils show high water absorption and poor impact and abrasion resistance. This drawback has been overcome by the Central Building Research Institute (CBRI), Roorkee, which has developed a process for the manufacture of good-quality tiles from alluvial soils. These flooring tiles can be produced in three sizes, viz. 150 x 150 x 15 mm; 200 x 200 x 20 mm; and 250 x 250x 25 mm.

These tiles possess uniform texture and colour, a metallic sound and finish. Their characteristics, viz. flexural strength, water absorption, and abrasion resistance, accord with the IS specifications for first-class tiles.

COST The estimated investment for a total plant for producing 2500 tiles per day is Rs 1 lakh and the working capital is Rs 0.65 lakh. Tiles are available at Rs. 600-700 per thousand.

CONTACT AGENCY

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LOW COST HOUSES

LOW-COST RURAL HOUSING

The need for low-cost houses has assumed significance in view of increasing cost of RCC structures and prevalent poverty in the rural areas. The various civil engineering based research institutions of the country have devoted considerable efforts and resources to develop alternative building materials and construction technologies to reduce the cost of construction. The organisations like NBO and HUDCO have consolidated these alternative designs. A number of alternative designs based on availability of local materials, climatic variations and local skills have been developed. A few of the illustrative schemes are:

* Brick panel roofing with water proofing course, country burnt bricks in mud mortar walls, frameless doors with cheap local wood hinged at top and bottom, Rubble stone in mud mortar plinth and kutcha flooring, sanitary latrine and water disposal. (Cost: Rs. 50 per sq ft. *)

* Mangalore (burnt clay) tiles on rafters and purlins roofing; burnt brick in mud mortar wall, cheap wood doors, brick jali for window, kutcha flooring and rough stone in mud mortar and hammer dressed stone in mud mortar plinth with sanitary latrine and water drainage. (Cost : Rs.38 per sq ft *).

* 10 cm thick stone slabs with 10 cm thick lime terracing roofing, babul wood doors amd windows, stone masonry in mud mortar wall, 7 cm thick stone slab flooring, stone masonry plinth with sanitary latrine and water drainage. (Cost : Rs. 30 per sq ft.*)

LOW COST HOUSES

COST * The above costs are relevant to area where the specific raw materials are available in abundance.

CONTACT AGENCY

National Buildings Organisation
Nirman Bhavan
New Delhi 110 011

DEMONSTRATION OF FIRE-RETARDANCY OF TREATED AS WELL AS UNTREATED THATCH. THE TREATED THATCH HAS NOT CAUGHT FIRE.

FIRE - RETARDANT THATCH ROOF

Most of our villagers live in huts and mud houses with thatched roofs. These roofs need constant maintenance and renewals nearly every year. The greatest hazard associated with such roofs is that in summer months these roofs are prone to catch fire easily. The fire from a burning hut could spread to a group of huts or even to the whole village itself. These roofs are not hazard-free in rainy season also as rain water leaks through them.

With a view to minimizing losses arising from fires and rains to life and property in villages, the Central Building Research Institute, Roorkee, has developed a technique of making improved roofs from thatch. The thatch could be made of paddy straw, coconut leaves or palmyra leaves or reeds. The life of the improved thatched roof is 4-5 years, as against about a year of the traditionally made thatched roof. The roof is rendered leak-proof and fire-retardant.

COST A labour-oriented technique, it can be learned by the villagers themselves. The cost of construction works out to about Rs 32/sq metre (Rs 5/sq ft).

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NON-ERODABLE MUD PLASTER

Mud houses in rural areas are prone to soil erosion during the rainy season. A simple technology of plastering with a non-erodable mud plaster can make the standing mud walls water-proof. The mud plaster can be prepared easily in the village. The process consists of the following stages:

(1) The soil used for preparation of mud plaster should neither be too clayey nor too sandy. It is preferable to use 1.8 kg of chopped and crushed wheat stem *(bhusa)* for every cubic foot of soil. The soil and *bhusa* should be mixed well, kept wet and kneaded every day for about a week. As a result, the workability is improved and the required decomposition of the *bhusa* is ensured.

(2) In the second stage, bitumen (45 kg; 80/200-grade) is first heated. The molten bitumen is poured into kerosene (9 kg) slowly while stirring the whole mass. Stirring is continued even after all the ingredients have been added to ensure a thorough mixing.

(3) Once the mud compound and cutback is ready, the final product is to be prepared. For every cubic foot of soil and *bhusa* mixture, 1.8 kg of cutback should be added. The mud plaster should be turned over with a shovel and kneaded well. The mud plaster is now ready for application on mud walls.

(4) A thickness of 1.5-2 cm mud plaster makes the wall non-erodable. When the plaster dries up it may develop some shrinkage or cracks. The cracks should be filled with additional applications of mud plaster.

(5) Finally, a dung wash should be applied all over the walls and allowed to dry for 24 hours. The dung wash consists of one part of dung and one part of soil mixed well with 2 kg of cutback.

COST Approx. 15-20 paisa per sq. foot.

CONTACT AGENCY

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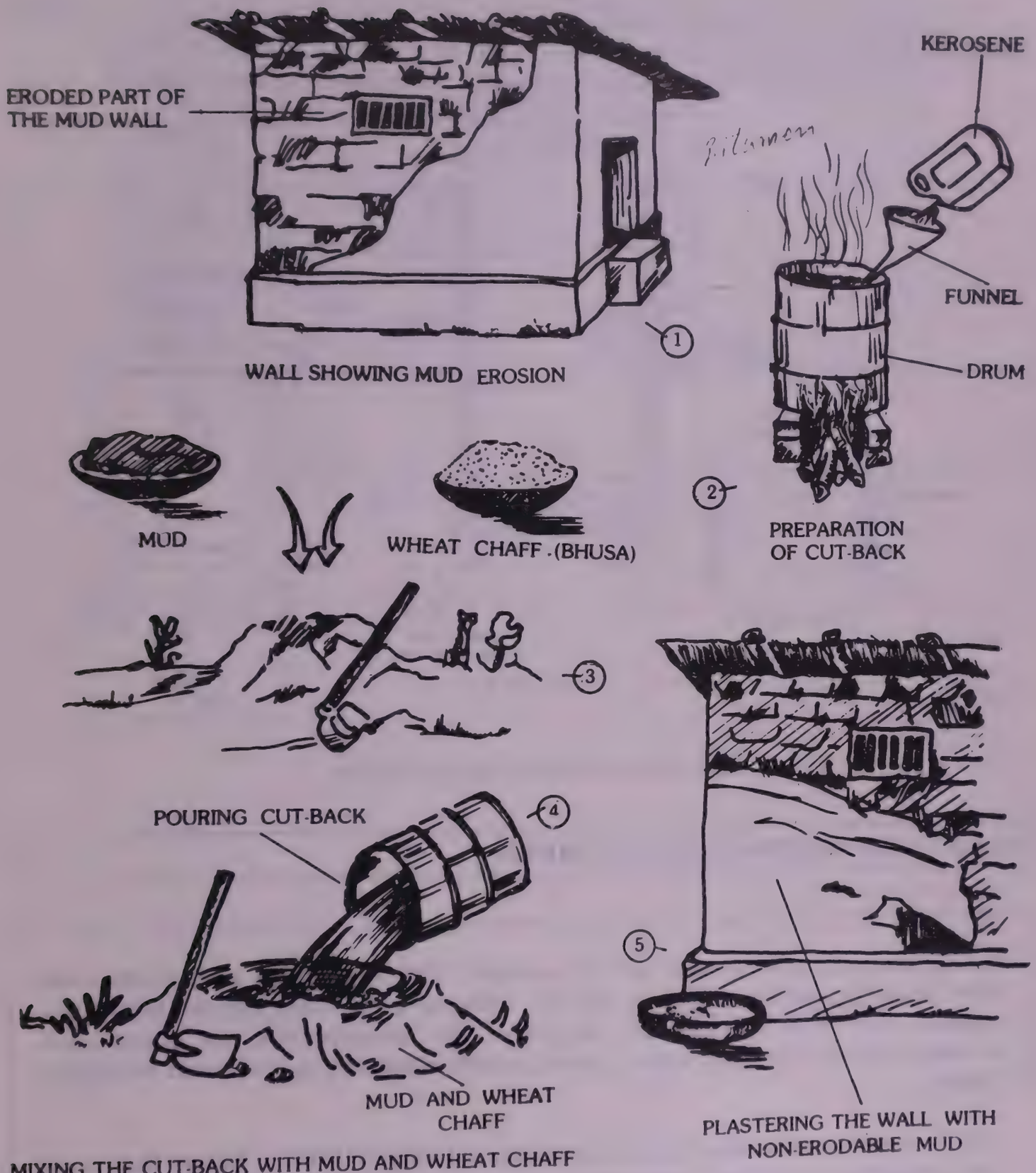
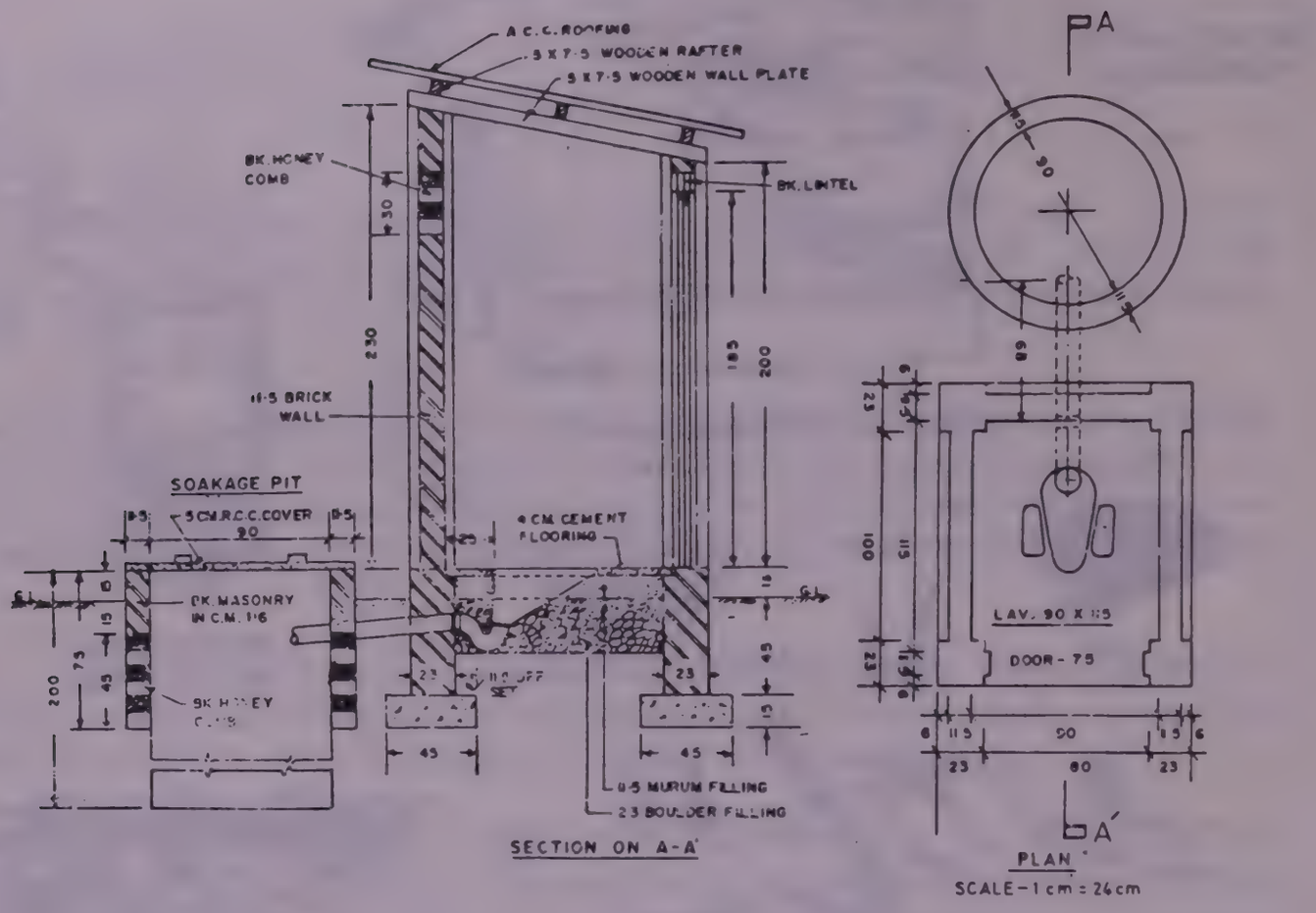


NON- ERODABLE MUD PLASTER



HAND-FLUSH WATER SEAL PIT LATRINES

HAND-FLUSH WATER-SEAL PIT LATRINES

In rural areas, defecation in open fields is a common sight. In a number of towns and small cities, bucket-type of latrine is used and the night-soil is collected and transported for disposal. Both these practices are unhygienic and are responsible for transmission of water-borne diseases like cholera, typhoid, infectious hepatitis, dysentery and helminthic ailments.

The National Environmental Engineering Research Institute (NEERI), Nagpur has, therefore, developed the design for hand-flush water-seal pit latrines for use in rural and semi-urban areas. This type of latrine holds human excreta in covered pits. It is thus not accessible to insects, flies, etc. and also to running surface water. Disease-causing organisms, if present in the excreta, die a natural death in the closed pits. The pit latrine converts human excreta into useful manure containing fertilizer elements like N, P and K and solves the problems of sanitation.

COST The latrine, i.e. pan, trap, construction up to plinth level, the junction chamber and covered lined pits, costs about Rs 1000. The manure collected in the pits would be worth Rs 100 per year when the latrine is used by a family of 5 members.

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LOW-COST RURAL LATRINES

LOW-COST RURAL LATRINES

The use of flush latrines in rural houses has not yet become popular in villages because of the lack of regular water supply and sanitation systems, Furthermore, the cost of flush latrine is much beyond the capacity of an average villager. Hence, the Central Building Research Institute, Roorkee, has developed an appropriate system of providing flush latrines in rural areas - a system which is within the means of villagers and which does not need the common services that towns and cities are provided with. The system consists of a 90 cm x 75 cm pour-flushed water-seal latrine with two leaching pits of one cubic metre capacity each. The toilet pan, made of reinforced concrete, has a steep slope so that flushing is achieved even with a small quantity of water. At a time, connection is made to one leaching pit which takes about 18 months to get filled up. Then the second pit is connected, and while this is getting filled up the first one is cleaned. The cycle is repeated. The system is simple, economical and hygienic. The toilet pans can be precast in the rural areas at a central place at nominal cost.

COST Rs. 800.

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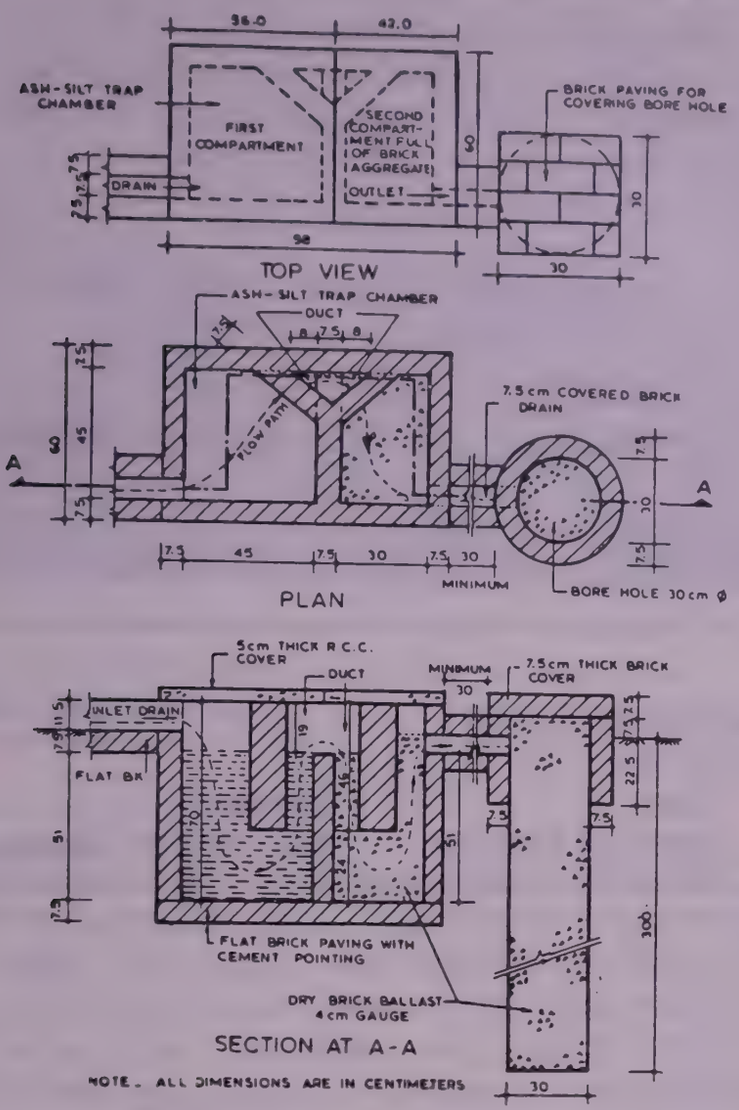

WASTE WATER DISPOSAL SYSTEM

WASTE-WATER DISPOSAL SYSTEM FOR RURAL AREAS

Village roads are generally brick-paved with drains for disposal of waste waters. But because of improper slopes, insufficient maintenance and unpredictable flow of water, these do not serve the required purpose. Waste waters from bathing and cooking areas of dwellings flow over the lanes and owing to the movement of carts and animals, ditches are formed. These remain full of stagnant, dirty water, serving as good breeding grounds for mosquitoes and flies. The Central Building Research Institute (CBRI), Roorkee, has developed a waste-water disposal system which is within the economic reach of a villager and can be maintained without outside assistance.

The system consists of an ash-silt trap chamber and a borehole. The chamber, of rectangular shape, is constructed near the waste-water outlet. It is divided into two compartments, each having a triangular duct adjacent to a corner diagonally opposite to the inlet. A hole is left in the partition wall 11.5 cm below the top to connect the ducts. The second compartment is filled with a 4 cm gauged brick ballast. The two compartments are covered with an RCC or reinforced brick lid.

This system works satisfactorily for about 4 months during which period the ash-silt gets collected and water starts overflowing owing to the choking of the lower mouth of the connecting duct. At this stage, the owner is required to clean the ash-silt deposited in the first chamber. This puts back the system in service. The brick aggregate in the second chamber is to be cleaned after about 8 months.

The whole system is covered and is below the ground level, and hence there is no hindrance in the movement of water nor any chance of mosquito breeding.

COST The total cost of the system is about Rs 200, which is within the means of an average villager.

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FERROCEMENT IRRIGATION AND DRAINAGE UNIT —

FERROCEMENT DRAINAGE UNIT

Seepage losses of irrigation water can be minimized by using lined irrigation channels connecting the water source and the fields. The Structural Engineering Research Centre, Ghaziabad, has developed semi-circular and trough-shaped ferrocement precast channels with a built-in jointing collar at one end. These channel units could be also used as drainage units in rural and urban areas. Ferrocement is a highly versatile form of reinforced mortar consisting of closely spaced layers of wiremesh reinforcement impregnated with a rich cement-sand mortar. It is possible to cast ferrocement elements with a thickness of as small as 1 cm. Ferrocement possesses high resistance to cracking and is highly impervious to water. It is lighter than reinforced concrete or drainage units. Cheaper than RCC or masonry semi-circular drainage or irrigation channels, precast units help faster laying of channels. Collar connections provide leak-proof, strong joints. Easily repairable by the farmers themselves.

COST Dia. 30 cm, semi-circular unit -- Rs 25.00 per running metre. Dia. 40 cm, semi-circular unit -- Rs 32.00 per running metre.

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Burning of rice husk of lime sludge for building material

BUILDING MATERIALS FROM RICE HUSK

Rice husk on complete burning yields a mineral residue (ash) to the extent of about 20 per cent of its weight. Since the ash is composed mainly of silica, efforts have been made to utilize it as a component of siliceous building materials. As a pozzolana, rice husk ash has been used in conjunction with lime for making masonry mortars in brick-laying, plastering, etc. After blending with ordinary portland cement the ash has been used as a constituent of portland pozzolana cement (PPC). The two precesses developed for the utilization of rice husk for making building materials consist in making (i) reactive pozzolana based on a mixture of clay and rice husk silica; and (ii) cementitious binder from lime sludge and rice husk. The material is suitable as a binder for making masonry mortar, in soil stabilization, and as a lean concrete for foundations and floors. The process is good for the utilization of agricultural wastes in the manufacture of building materials in rural areas and is labour-intensive. Except for a ball mill, no major equipment is needed. Production units can be set up around rice mills.

COST Total capital investment for a unit of 5 tonne/day capacity is about Rs. 1.5 lakh.

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FLY-ASH BRICKS

Indian coals have a very large ash content. A large amount of ash is produced with the use of coal in thermal power plants. When the ash particles come in contact with water, they stick together and become hard. This property has been utilized in the preparation of bricks by the Central Fuel Research Institute, Dhanbad. The bricks made from fly-ash, the waste material of thermal power plants, are an effective building material and are much better than conventional bricks in several ways.

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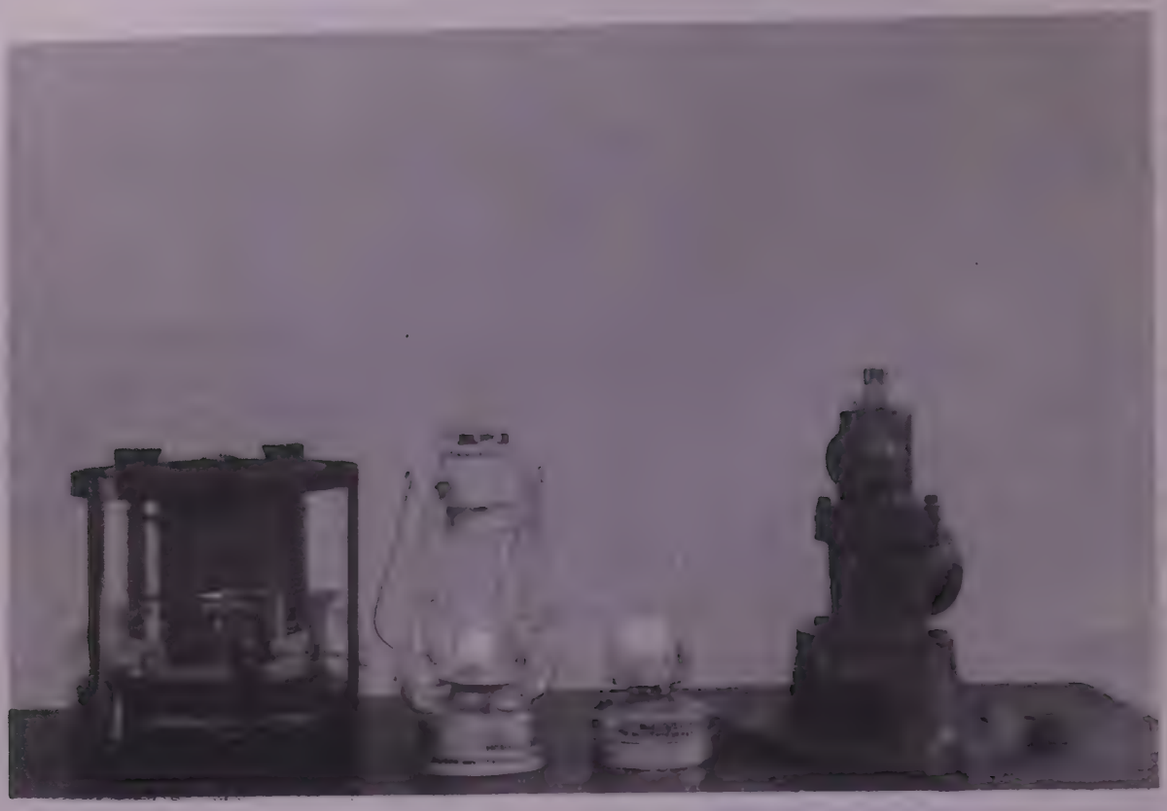

Improved IIP Wick Stove, Lantern, Lamp and LAP 'Film' Burner.

HEATING AND LIGHTING APPLIANCES

The Indian Institute of Petroleum, Dehra Dun, has improved the burner design of the existing *Deva* lamp, table lamp and hurricane lantern burning with kerosene to produce more illumination, and kerosene-fed wick stoves to produce more heat for cooking. These appliances are widely used in rural and semi-urban areas. This is a low-cost technology of specific relevance to the rural areas. Fuel conservation is also effected in these lighting and heating appliances. The *Deva* lamp, table lamp and hurricane lantern are used for illumination. The Nutan-2 wick stove is used for heating/cooking purposes.

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A RURAL ROAD IN THE MAKING BY THE VILLAGERS THEMSELVES USING LOCAL MATERIALS

LOW-COST TECHNIQUES FOR RURAL ROAD DEVELOPMENT

Rural roads play a vital role in the overall socio-economic development of the rural areas in a country like India with a predominantly agrarian economy. However, only a third or so of about six lakh villages in the country have all-weather roads. Because of the very nature of the problem and also because of the very limited funds available, technologies appropriate for rural road development in India cannot be acquired from the developed countries in the West. Hence, the Central Road Research Institute (CRRI), New Delhi, has developed low-cost techniques for the development of rural roads. The techniques relate to the planning, design, construction, and maintenance of rural roads. Only such techniques, materials, specifications and standards have been recommended as are considered achievable in our rural areas. Only locally available materials like sand, gravel/moorum and soft aggregates need be used to the extent possible, instead of the conventional hard stone.

A large number of experimental lengths and specially designed test tracks laid in different parts of the country have shown that adoption of CRRI's low-cost techniques can bring about 20-25% savings in comparison with those achieved through the conventional techniques.

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IMPROVED SOLID-WHEELED BULLOCK CART

IMPROVED SOLID - WHEELED BULLOCK CART

The Central Road Research Institute, New Delhi, has developed an improved design of a solid-wheeled bullock cart by inserting a flexible element in the hub to allow for the self-adjustment of the wheel axle system. The flexible element reduces the tractive effort and improves the contact between the cart wheel and the road surface, and hence reduces the damage to the road surface. Field tests carried out with the solid-wheeled cart with the flexible element showed a substantial increase in the wheel contact area and a significant reduction in tractive effort which, in turn, reduced the damage to the road surface.

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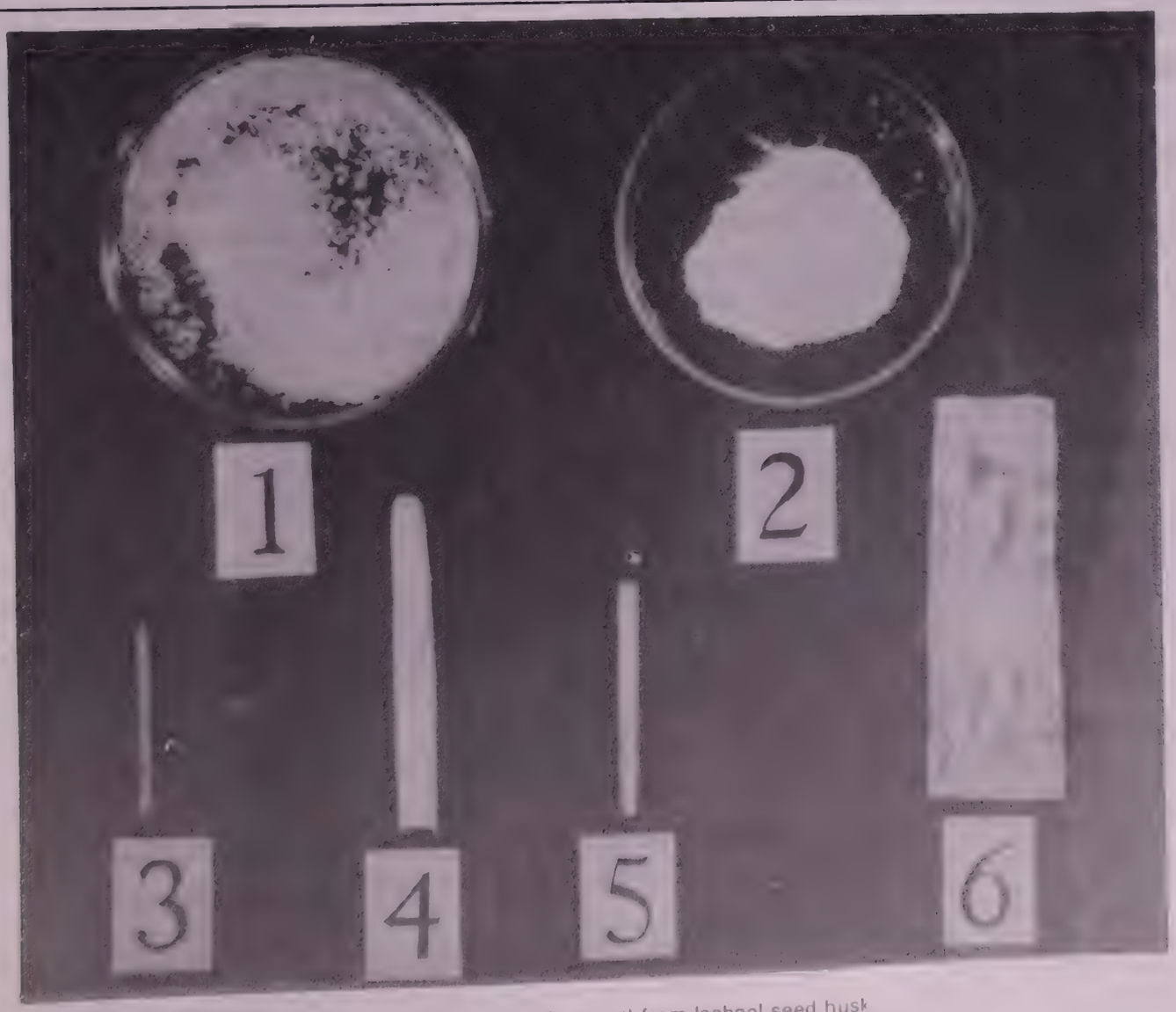
B. FOOD, HEALTH AND FAMILY WELFARE

CERVICAL DILATOR

Medical termination of pregnancy (MTP) is an important component of the national family planning programme. In this context, the Central Drug Research Institute (CDRI), Lucknow has developed cervical dilator (Isaptent), which is a substitute for the imported laminaria tent used in MTP operation. After Isaptent dilates the cervix, the foetus is removed through the usual procedures. The device is made from isabgol seed husk, a commercial crop grown abundantly in India. The technology is simple and labour-intensive. The product provides 9-11 mm dilatation of the cervix within 5 hours of the insertion. Thus, cases can be discharged from the clinics and hospitals the same day after the MTP. The device is more effective, safe and less costly than the imported laminaria tent. The raw materials used in its manufacture are all indigenous.



A new cervical dilator (Isaptent) from Isabgol seed husk

COST Continuous process with a capacity to produce 5000 devices a shift per day will need an investment of Rs. 30 lakh. In the case of cottage industry scale, the cost will vary with production capacity, cost of raw materials and local labour rates. The cost of one pair of dilator is Rs. 6.

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TRIBAL PEOPLE AFFECTED WITH GOITRE DUE TO IODINE DEFICIENCY

IODIZED SALT FOR GOITRE CONTROL

To maintain good health we need minerals and other trace elements in the diet. Iodine is an important trace element which controls the rate of metabolism and regulates the body temperature. Insufficient quantities of iodine in the normal food enlarge the thyroid gland, leading to a deficiency disease known as goitre. Recent estimates show that about 120 million people in India suffer from goitre. So far, the most satisfactory medium developed for iodine intake is salt. To meet this need of the masses, the Central Salt & Marine Chemicals Research Institute, Bhavnagar, has developed a simple and labour-intensive process for manufacture of iodized salt. The process involves submersion of solar salt in saturated brine containing a sufficient quantity of calcium iodate, followed by draining or centrifuging. The necesary level of iodine in brine is maintained to get 15 ppm of iodine in iodized salt (IS:7224). By this process, iodine is distributed uniformly and is more stable.

The process can be adopted on a cottage/small scale of 1-10 tonnes/day. A mechanical plant of a capacity of 100-200 tonnes/day could also be set up.

COST Continuous iodization by the submersion process with a capacity of 100 tonnes per shift requires an investment of about Rs 6.0 lakh.

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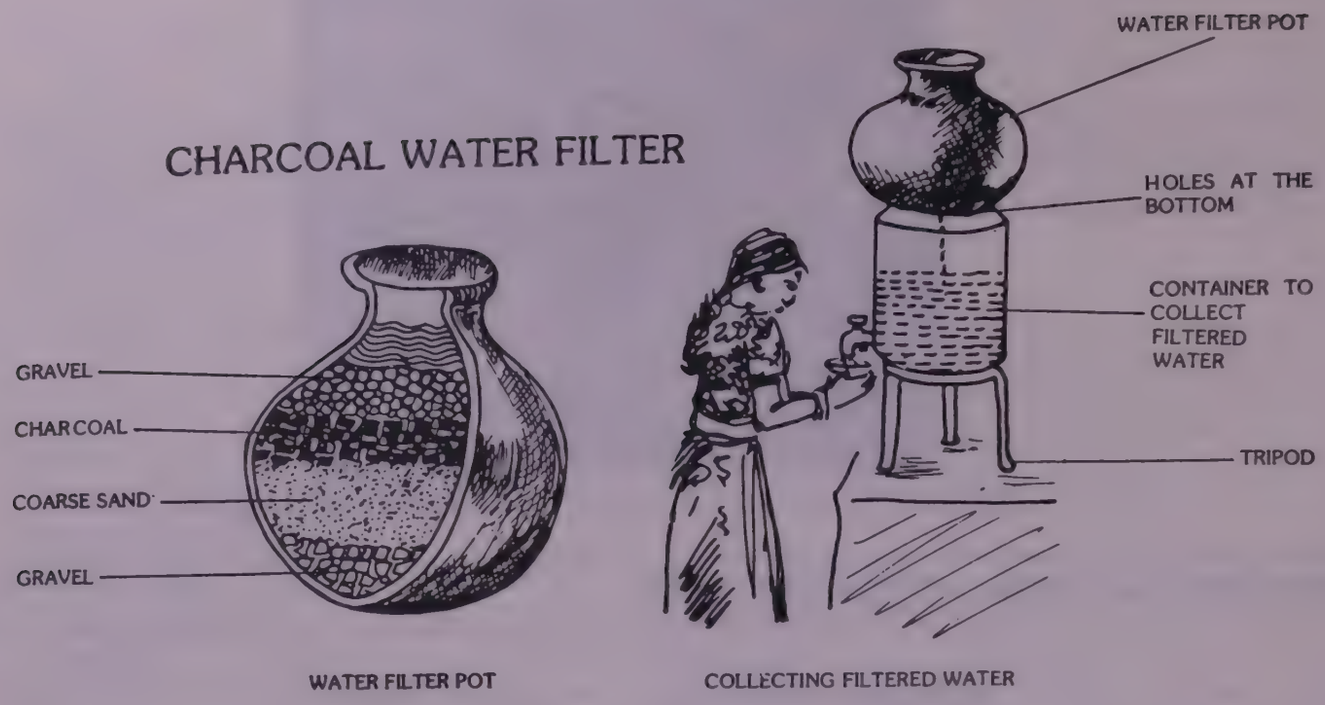

CHARCOAL WATER FILTER

The charcoal water filter is an effective technique for removing solids, suspended materials and other harmful bacteria. It can filter sufficient drinking water for one family.

A clay pot (42 cm diameter and 100 cm height) is fitted with a tap at the bottom. Gravel, sand and charcoal are first thoroughly washed. Then, gravel is put into the pot up to a height of 25 cm. This layer removes the dust and dirt. Above this, coarse sand is piled for a height of 25 cm. This layer is covered with a 15 cm bed of charcoal, which is again covered with a 5-10 cm thin layer of gravel. The latter prevents the charcoal pieces from floating and keeps them stationary. All the different layers would occupy roughly two-thirds of the pot. Water can now be poured into the pot and filtered water drawn through the tap at the bottom. If a tap is not available, a few holes can be made at the bottom of the pot which should be placed on an empty domestic container. In this way filtered water is collected in the container for drinking. It is advisable to add a few drops of chlorine solution to a jug of water as a disinfectant.

The filter requires cleaning or renewal of the beds when these become clogged and this could occur every three months in case of unclean water. Larger clay pots may be used to avoid frequent washing. All materials are locally available in the villages.

COST Rs. 40-50 per filter.

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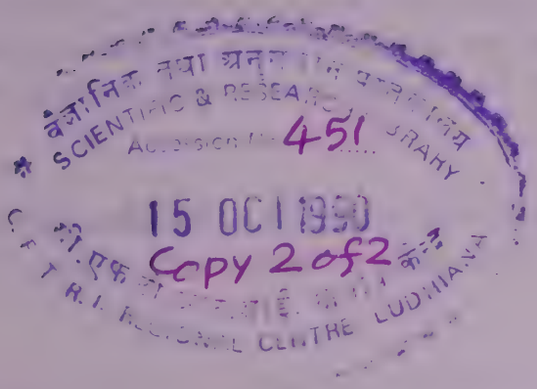
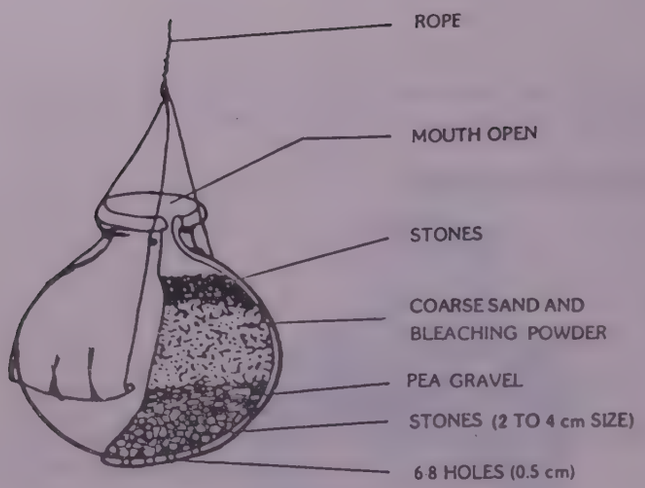
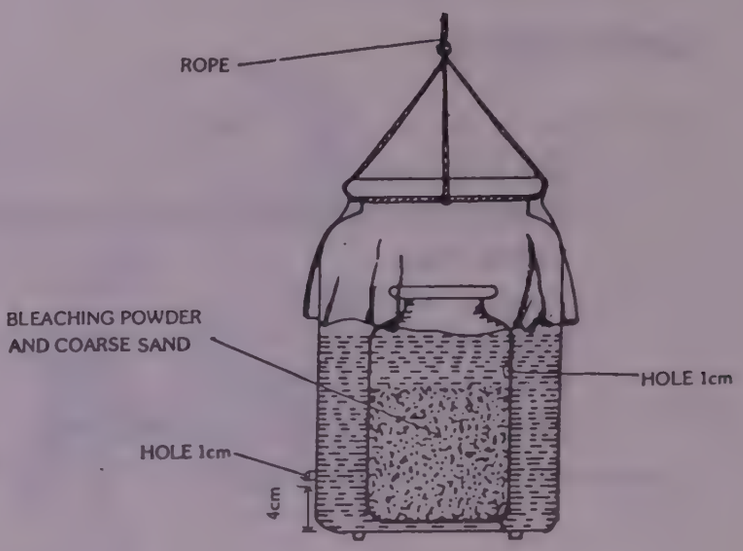




SINGLE-POT SYSTEM FOR COMMUNITY WELLS



DOUBLE-POT SYSTEM FOR HOUSE HOLD WELLS

CHLORINATION POT FOR WELLS

CHLORINATION POT FOR WELLS

This pot effectively chlorinates water in open dug wells up to three weeks. A pot of 7-8 litres capacity is taken and 6-8 holes of half a centimetre diameter are made at the bottom. The holes are covered with stones or pebbles of 2-4 cm size. This layer is covered with pea gravel of smaller size. A dry mixture of 1.5 kg of bleaching powder and 3 kg of coarse sand is prepared and spread over the pea gravel. Finally, the pot is filled with pebbles or stones up to the neck. Now the pot is lowered in a well with the help of a rope about one metre below water level.

One pot is enough for a community well where 900-1300 litres are drawn per day. This gives adequate chlorination for 10-15 days. Wells with higher drawn-off rates need two chlorination pots.

The above system, suited to community wells, would excess-chlorinate the smaller household wells. Hence, the necessity for a smaller unit for wells containing about 4000 litres or less having a withdraw a rate of 360-450 litres of water per day, a unit consisting of two cylindrical pots - one inside the other-may be employed.

The inner pot is filled with a moist mixture of 1 kg of bleaching powder and 2 kg of sand and is placed in the outer pot. A hole of 1 cm diameter is provided in the inner pot at the level of the mixture placed in it. Similarly, 1 cm diameter hole is to be made 3-4 cm above the bottom of the outer pot. The mouths of both the pots are tied with polythene sheets. The entire unit is lowered into the well which chlorinates the water for 2-3 weeks. However, wells with hard water may not yield the expected results.

COST Approximately Rs. 25-30, which includes the cost of a pot, rope and bleaching powder.

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SAMPLES OF CHLORINE TABLETS, CHLORINE AMPOULES, AND KIT FOR MEASURING RESIDUAL CHLORINE

CHLORINE TABLETS AND AMPOULES FOR DISINFECTION OF POTABLE WATER

Water available for drinking may not be pure and may contain disease-causing microorganisms owing to pollution from human and industrial wastes. In rural areas, there is very little quality control on water for domestic use. Safe water can be ensured better by disinfecting it at the households. In such circumstances, chlorine tablets and ampoules developed by the National Environmental Engineering Research Institute, Nagpur, become handy and are, in fact, now being widely used. The chlorine tablets and ampoules are quite cheap for disinfection of potable water. The tablets/ ampoules provide safe and bacteria - free water for drinking.

COST A family of five can have the benefit of safe drinking water by spending just 5-10 paise a day.

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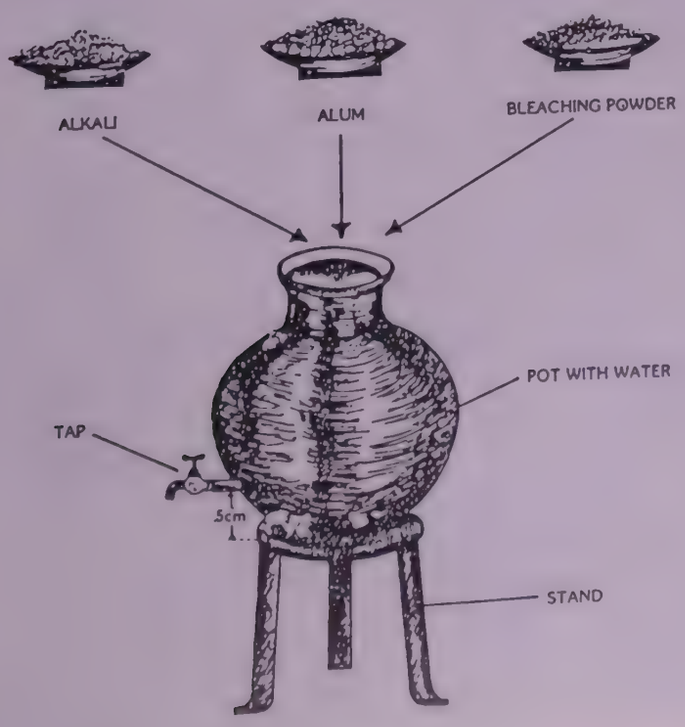
DEFLUORIDATION OF DRINKING WATER

Water containing excessive fluorides consumed over a period of 8-10 years leads to a disease known 'fluorosis' in human beings as well as in animals. Fluoride is a causative agent in dental fluorosis or mottled enamel. A high concentration of fluoride in drinking water also results in bone deformation and permanent crippling. Fluoride belts have been identified in Andhra Pradesh, Tamil Nadu, Karnataka, Maharashtra, Madhya Pradesh, Gujarat and Rajasthan.

The presence of fluoride ion in drinking water is beneficial up to a concentration of 1 mg per litre. Beyond this limit, it is detrimental to health, causing fluorosis of teeth and bones. The National Environmental Engineering Research Institute (NEERI), Nagpur, has developed a simple method, known as the Nalgonda Technique, for the removal of excess fluoride from potable water.

Water drawn from wells with high fluoride content is taken in a container of, say, 20-60 litres capacity. If possible a tap is fitted 3-5 cm above the bottom of the container to withdraw the treated water. However, this is not essential. Raw water in the container is mixed with adequate lime and alum depending on alkalinity, dissolved solids and flourides in the raw water. The technique is very simple and could be adopted by rural people.

DEFLUORIDATION OF DRINKING WATER



NALGONDA TECHNIQUE

COST The cost of treatment is between Re. 0.50 to 1.0 per litre of water.

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SAFE DRINKING WATER THROUGH WATER FILTER CANDLES

Water-borne diseases are quite common in villages. Infants and children are more susceptible to such diseases. Therefore, the supply of safe drinking water has been emphasized in the 20 Point Programme of the Government of India. Raw water contains harmful bacteria which have to be removed to make it potable. As a solution to this problem, the Central Glass & Ceramic Research Institute, Calcutta, and Regional Research Laboratory, Jorhat have developed water filter candles which, fitted to domestic water containers, including earthen pitchers, can meet the daily requirements of an average family. These candles provide bacteria-free water.

The candles are convenient to use in domestic water containers. The manufacturing process is more or less similar to the ceramic manufacturing technique followed in any pottery plant. Life of a candle is 2-3 years.

COST It is estimated that a unit with a capacity to produce 70,000 candles per annum would need an investment of Rs 6 lakh. The cost of one water filter candle is approximately Rs. 100.

FILTER CANDLES MANUFACTURING AT SENGELIGAON (JORHAT)

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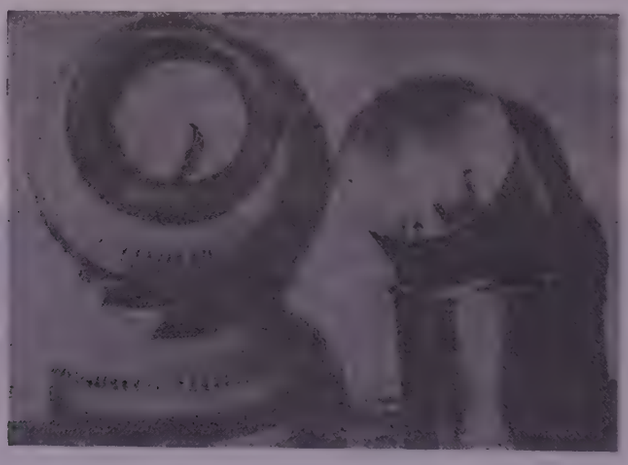

Domestic Water Purification System

Indian multi-purpose food.

MULTIPURPOSE ENERGY FOOD

Multipurpose food (MPF) developed at the Central Food Technological Research Institute, Mysore, is a blend of edible processed groundnut meal and Bengal gram flour with added vitamins and minerals. MPF is primarily intended to supplement the diet of children and expectant and nursing mothers. It can also be used by all. Feeding trials have shown that MPF is very effective in curing the protein deficiency disease kwashiorkor. The process consists in roasting edible groundnut cake and Bengal gram, grinding them well, and adding vitamins, minerals, and spices.

COST For a plant of capacity 3 tonnes per day of MPF, the installation cost will be Rs 12 lakh. The cost of MPF is Rs. 8 per kg.

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Flaker for rice flakes

RICE FLAKES - IMPROVED METHOD

The traditional method of preparing rice flakes consists in sand-roasting soaked paddy followed by flaking. This results in low yields, excessive breakage during the final stage of flaking and contamination with husk particles in the flaked rice. The Central Food Technological Research Institute, Mysore, has standardized a batchwise as well as a continuous process of making rice flakes, which overcomes the drawbacks of the traditional method. The improved process consists in soaking the paddy in hot water, roasting the soaked paddy, shelling, polishing, and finally flaking in a flaker.

COST The capital investment is around Rs. 19 lakh for a plant capacity of 5 tonnes paddy in 2 shifts.

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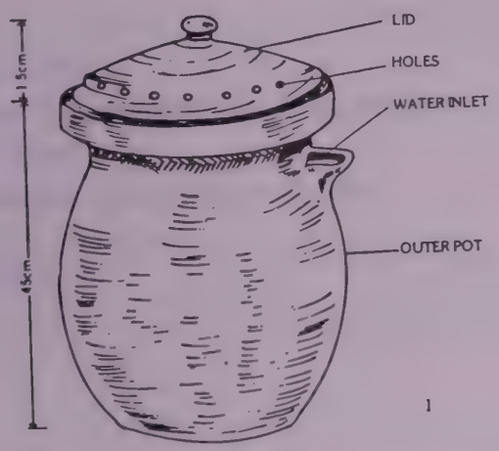
SHEETAL POT

This is used to store vegetables, fruits, milk and cooked foodstuff to keep them fresh for about a week.

There are two pots - one inside the other. The inner pot serves as a container for vegetables, cooked food, milk and other items of food. The outer pot serves as a reservoir from which water evaporates through its pores. Continuous water evaporation produces a cooling effect and the water in turn cools the inner pot. A difference of 11 degree C temperature has been noted between the inner and the outer temperatures. Water is filled through an opening which is on the upper side of outer pot. A common lid is provided for both the pots. The lid has perforations on the sides which allow the vapours to escape from the stored material. The following precautions are necessary to get maximum benefits:

-- The inner pot should be clean and dry. -- Water used must be clean. -- The outer pot should not be left without water lest the inner pot gets heated and the stored material becomes rancid. -- Water should be changed daily. -- Sheetal pot can be made easily by a village potter.

SHEETAL POT



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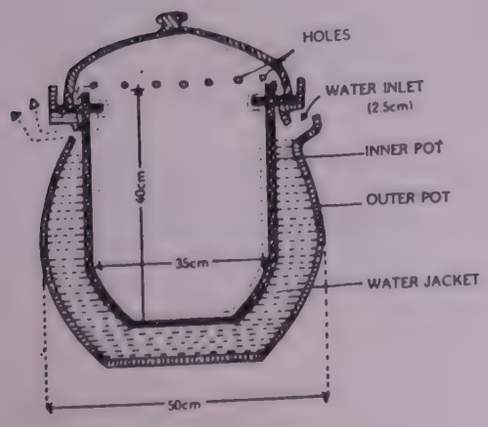
COMPLETE UNIT



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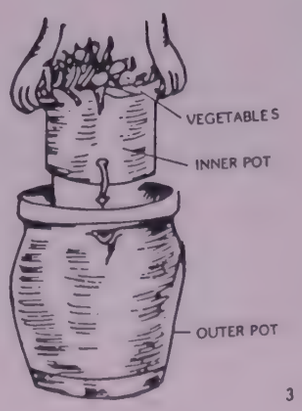

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COST Rs. 25-35.

CONTACT AGENCY

Centre of Science for Villages
Ceramic Unit, Magan Sangrahalaya
Wardha 442 001
Maharashtra.

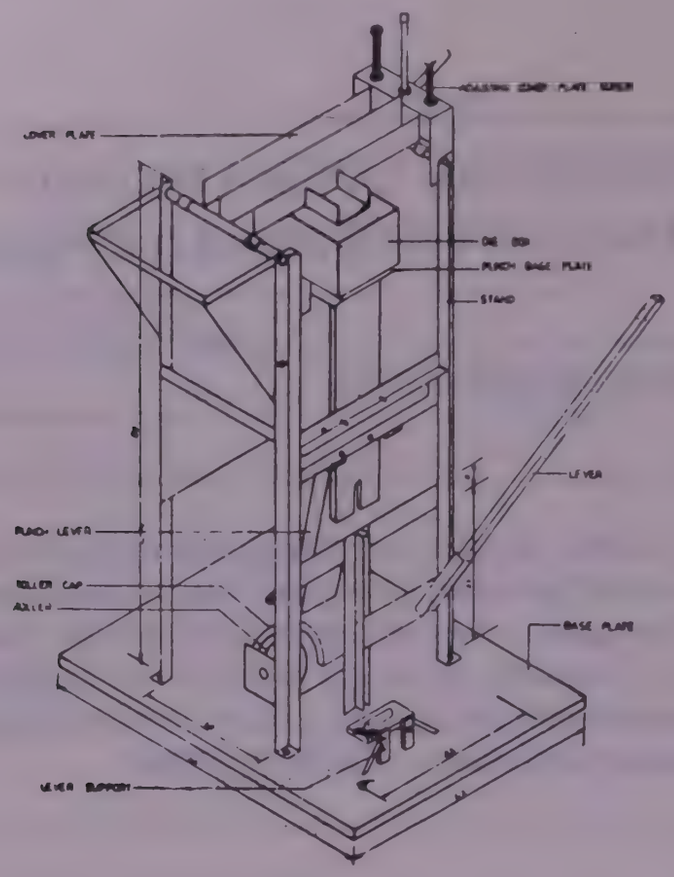
C. ENVIRONMENTAL UPGRADATION AND USE OF NON-CONVENTIONAL ENERGY

AGRO-WASTE COMPACTION MACHINE

In villages where groundnut oil mills, saw mills, sugar mills, paper mills or coir industries are located, agro-wastes like groundnut shells, saw dust, bagasse, bamboo dust and coir pith are available in large quantities. A power-operated compaction machine with a capacity to produce about 500 kg of briquettes per day (8 h) has been designed. The briquettes can also be used in the boilers of these industries, thus minimizing dependence on coal whose production and distribution has become a national problem.

CONTACT AGENCY

The Managing Director
National Research Development Corporation
'Anusandhan Vikas'
20-22, Zamroodpur Community Centre
Kailash Colony Extension
New Delhi - 110 048.



PULVERISED CHARCOAL BRIQUETTES MAKING MACHINE

PULVERISED CHARCOAL BRIQUETTES

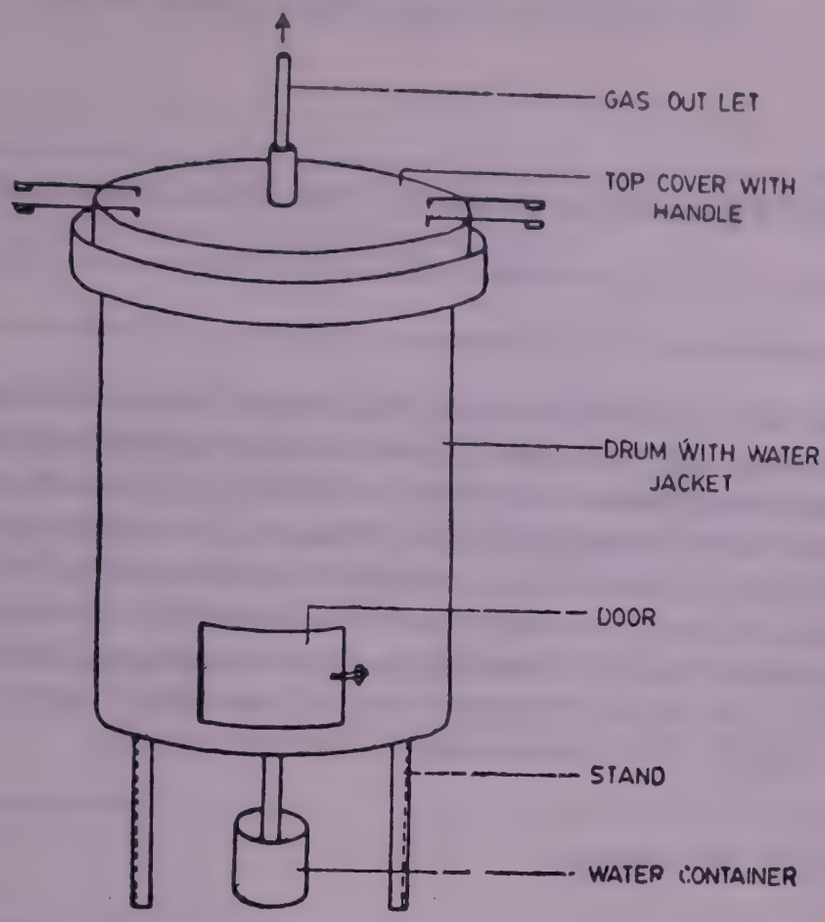
The pulverised charcoal briquettes burn with smokeless flame and could be used as an efficient and clean fuel in rural areas. The briquettes are produced by a hand operated die and punch type briquetting machine. The pulverised charcoal is filled in the dies and pressure is exerted by hand through handle of the machine to obtain briquettes. The machine has a capacity to produce 8 briquettes in operation and 35-40 kg of briquettes per day. The machine can be easily operated be one man and is portable.

COST Rs. 3500. The cost of 1 kg of briquettes is Rs.15.

CONTACT AGENCY

Centre for Development of Rural Technology
Institute of Engineering and Rural Technology
26, Chatham Lines
Allahabad 211 002

Telephone	Telex	Telegram
55526, 53792	540-260 IERT IN	APOLY, Allahabad



PYROLYSER

PYROLYSER

A cylindrical drum-type pyrolyser with a capacity of 200 litres has been developed by Centre for Development of Rural Technology, Allahabad. 40-45 kg of dry waste can be fed and about 20 kg of charcoal can be obtained from the pyrolyser in a day. Agro-wastes, like dry leaves and sticks, which pose disposal problems can be converted into valuable smokeless fuel with good heat content. The briquettes made from the charcoal obtained from agro-wastes burn with a smokeless flame.

COST Rs. 1800.

CONTACT AGENCY

Centre for Development of Rural Technology
Institute of Engineering and Rural Technology
26, Chatham Lines
Allahabad 211 002

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GROWING OF AUSTRALIAN BLACK WOOD ACACIA *(ACACIA MELANOXYLON)* FOR FODDER

This tree has wide adaptability and is extremely hardy and resistant to drought and frost. The branches can be lopped generally after 10 years, twice in a year, for leaf fodder. The leaves of the lopped branches make an excellent fodder and can be fed to cattle when the grass cover dries up owing to frost and drought during the winter and summer periods (November-April) in the Nilgiris. The tree is used as a wind belt, as an ornamental and as shade besides as fodder and timber. It can be grown in agricultural field boundaries and on land unsuitable for cultivation. It grows to a height of over 30 m, seldom exceeding 2 m in girth. The leaves, which form about 53 per cent of the lopped branches, are richer in nutrients than grasses and non-leguminous fodder. The leaves contain 11.2% crude protein.

COST Rs. 3000 to Rs. 5000 per ha.

CONTACT AGENCY

The Director
Central Soil & Water Conservation Research
& Training Institute - Research Centre
218, Kaulagarh Road,
Dehra Dun 248 195(U.P.)

RAISING OF FAST-GROWING FIREWOOD PLANTS

Firewood, a vital material in the lives of rural people, is steadily becoming scarce and as a result its price is soaring. Realizing such an alarming situation of the rural poor, the Regional Research Laboratory, Jammu, has made concerted efforts to supplement firewood needs of the rural communities. Species so far identified for this purpose are *Leucaena eucocephala*, *Gmelina arborea* and *Sesbania sesban*. All these coppice vigorously and lend themselves to harvesting at short intervals of 2-3 years. They also give several crops year after year. There has been much demand for seeds of these species from all over the country.

CONTACT AGENCY

The Director
Regional Research Laboratory
Jammu-Tawi 180 001

Telephone	Telex	Telegram
46368	0377-231 RRLJ IN	REGLAB, Jammu

HARSHA

HIGH-EFFICIENCY MULTIFUEL STOVE (HARSHA)

For cooking food the rural as well as the urban poor burn solid fuels and agricultural wastes like firewood, wood chip, branch, leaf, twig, bush, groundnut husk, coconut husk, bagasse, cowdung cake, charcoal, coal, or coal briquettes depending on their availability. Conventional *chulhas* are used for this purpose, and these are thermally inefficient. Besides high fuel consumption, such *chulhas* cause smoke and health hazards.

The Regional Research Laboratory, Bhubaneswar, has developed a portable high-efficiency multi-fuel *chulha*, known as Harsha, which is highly suitable for rural as well as urban needs. The *chulha* can burn a variety of solid fuels and agricultural wastes in a very efficient manner with reduced fuel consumption at almost smokeless operation. Unlike other improved *Chulhas* developed in recent years, Harsha *chulha* can burn a single fuel or a combination of fuels (or agricultural wastes) available in villages, without choking the grate during the entire period of burning. Fuel saving is up to 40 - 50%. Overall thermal efficiency is of the order of 33% for firewood and 42% for cowdung cake combustion. Useful power rating is 1.5 kw for firewood and cowdung cake. Burning rate is 1.1 kg of firewood or 1.5 kg of cowdung cake per hour. The *chulha* is portable.

COST Rs. 90.

CONTACT AGENCY

The Director
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Bhubaneswar 751 013
Orissa

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HIGH-EFFICIENCY WOOD BURNING STOVE

The conventional mud *chulhas* used in rural and semi-urban areas are thermally inefficient, their nominal efficiency being around 10%. A considerable amount of heat is wasted owing to the undirected, wavering flame which loses heat to the walls of the *chulha*. The flow of combustion air, which is already insufficient, often gets obstructed and produces smoke. In such a condition, blowing of air and addition of more fuel become necessary to help the fire burn. The thick mud walls absorb considerable heat and so only a small fraction of the sensible heat reaches the food container.

A simple, high-efficiency wood-burning stove has been developed.This overcomes the above drawbacks and conserves firewood, thus saving the forest wealth from rapid depletion. The salient features of the new stove are: (i) a well-directed and central flame in the stove chamber; (ii) optimum quantity of air for mixing with fuel; and (iii) good mixing of combustion air with the volatiles liberated by the fuel. These design features have enhanced its thermal efficiency to more than 30%.

COST Varies from Rs. 60 to Rs.100 depending upon size.

CONTACT AGENCY

The Managing Director
National Research Development Corporation
'Anusandhan Vikas'
20-22, Zamroodpur Community Centre
Kailash Colony Extension
New Delhi 110 048.

PORTABLE SOLAR COOKER

A novel solar cooker developed by the Central Mechanical Engineering Research Institute (CMERI), Durgapur, has characteristics which are distinctly superior to those of other solar cookers developed and marketed in the country. The CMERI cooker consists of a collapsible, curved reflector (of about a metre diameter) mounted on a tripod light-weight stand. The reflector concentrates sun rays for cooking in a specially designed two-chamber pot. The stand can be manoeuvered to track the sun with manual effort. The total height of the unit is about 1.5 m. The components of the unit are detachable and can be kept in a small kitchen. The cooker is suitable for small families for regular as well as occasional use, as in camping. It takes less than 1.5 hours for cooking food in winter and much less in summer.

COST Rs 400.

CONTACT AGENCY

The Director
Central Mechanical Engineering Research Institute
Durgapur 713 209

Telephone	Telex	Telegram
2149	0205-213 CSIR IN	MECHSEARCH, Durgapur

SMOKELESS CHULHAS

SMOKELESS *CHULHAS*

Three types of smokeless *chulhas* (ovens), suitable for rural masses have been developed. These are:

a) *Biomass-compatible smokeless chulha*, suitable for domestic use; (b) *Improved portable chulha*, with special attachment for clear and efficient combustion of coal;and (c) *Double chamber chulha*, a simple oven in which the raw coal is carbonised simultaneously while the soft coke is being burnt for cooking. The gases produced are burnt at the same time to generate additional heat.

CONTACT AGENCY

The Director
Central Fuel Research Institute,
P.O. F.R.I.
Distt. Dhanbad - 828 108
(Bihar)

Telephone	Telex	Telegram
61807	0629-201 CFRI IN	RESEARCH, FRI, Dhanbad

SOLAR COOKER

The shortage of cooking fuels and their ever-increasing costs have created many hardships for housewives. Among the alternative energy resources the most easily available and plentiful is energy from the sun. The solar cooker which the National Institute of Oceanography, Goa, has developed goes a long way in aiding the housewife. A box-type device, the cooker measures roughly 50 x 50 x 35 cm and weighs about 35 kg. The cooker is provided with four black-anodized Indalium containers for cooking.

All the components are made of indigenous materials. Even rural artisans with a little training can fabricate the cooker. It is portable, can be dismantled, packed and reassembled easily. It is capable of cooking most of the common food items, helps in supplementing fuel needs and reduces cooking time.

COST Rs 450.

CONTACT AGENCY

The Director
National Institute of Oceanography
Dona Paula 403 004, Goa

Telephone	Telex	Telegram
4612	0194-216 NIO IN	OCEANOLOGY, Goa

SOLAR DRIER-CUM-COOKER IN THE COOKING PHASE; DRYING TRAYS ARE KEPT OUTSIDE THE COOKER — (NIO, GOA)

SUN DRYING OF CHILLIES

SUN-DRYING OF RED CHILLIES

Conventionally, chillies are collected from plants and sun-dried in open yards for 15 to 20 days to a moisture content of 15 to 20 per cent. This method is time-consuming, is unhygienic and gives lower yields owing to loss of seed through breakage. It also causes fading of colour during storage. The Central Food Technological Research Institute, Mysore, has developed an improved technique for sun-drying of chillies which has many advantages over the traditional method. The process involves dipping the red chillies in "Dipsol" solution developed at the Institute and then sun-drying. Dipsol is a water-based emulsion containing potassium carbonate, refined groundnut oil, gum acacia and butylated hydroxyanisole (BHA) in specified quantities and is mixed well using a homogenizer. The technique ensures a consistent end-product. The time taken for drying is only a week, compared to two to three weeks in the case of the traditional process. The technique requires less space and imparts better retention of colour and pungency.

COST It is estimated that a capital investment of about Rs 75,000 will be required for a plant with a capacity of 150 tonnes of fresh chillies per season to get 37.5 to 40.5 tonnes of dry chillies.

CONTACT AGENCY

The Director
Central Food Technological Research Institute
Mysore 570 013

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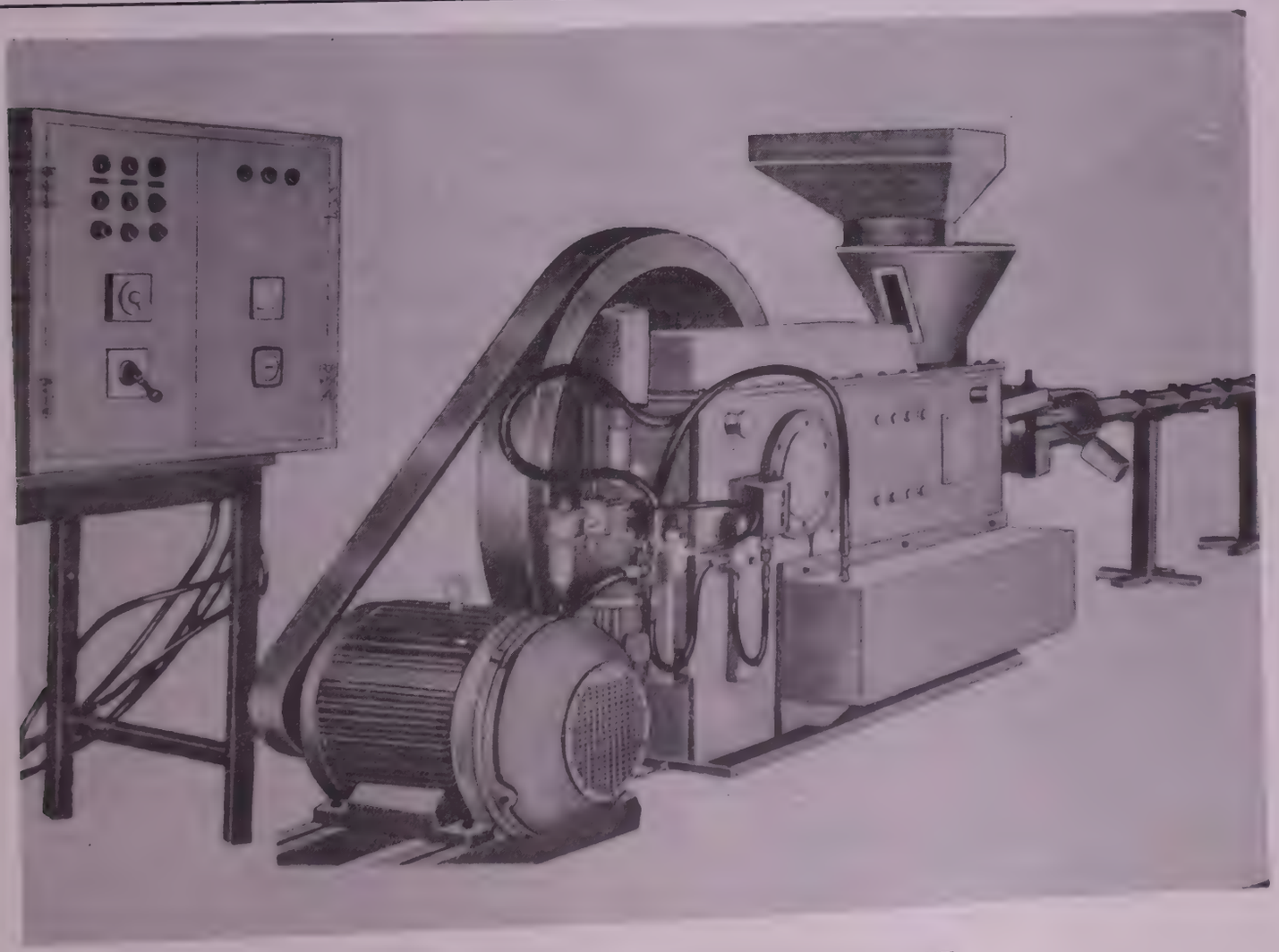
II TECHNOLOGIES FOR EMPLOYMENT GENERATION

BRIQUETTED FUEL MANUFACTURING PLANT

Briquetted fuel is the answer to the ever-increasing energy crisis. This unique alternative to natural coal is easily manufac tured from agricultural and forest wastes. With a calorific value of about 4000 kcal/kg, the briquettes are extremely suitable for domestic as well as industrial purposes. Some of the raw materials give superior briquettes particularly because of negligible ash contents while burning. The manufacturing process is extremely simple. Raw materials fed into a hopper are forced-fed between the punch and die, resulting in high compression and hence high temperature. Cylindrical briquettes are formed owing to carbonisation achieved by hardening of surface. Saw dust, coir waste (pith), groundnut shells, rice husk (de-oiled rice bran), pine needles (pulverised), hardwood shaving, softwood shaving, bagasse (pith), bark (pulverised), and plant leaves, etc. can be briquetted.



BRIQUETTED FUEL MANUFACTURING PLANT

CONTACT AGENCY

The National Small Industries Corporation Ltd.
"Laghu Udyog Bhawan", Okhla Industrial Estate,
New Delhi 110 020

Telephone	Telex	Telegram
637071	031-62131	SMALCORP, New Delhi

PAPAD PRESS

Papad is a popular food adjunct in India. It is essentially a thin wafer-like product, usually circular in shape, rolled from a dough made out of pulses and/or starchy materials with added salts and spices. The traditional method of making *papad* is by rolling the dough with a rolling pin. In recent years, with the demand for the papad growing both in India and abroad, *papad*-making has developed into cottage-scale and small scale industries.

The Central Food Technological Research Institute, Mysore, has developed a leg-operated press, adopted from the leaf cup-making machine, for making *papad* from the dough. The machine consists of a male and a female disc. This is connected to the central rod which is movable up and down by pressing the pedal. By using this press one can make 600 *papads* per hour as compared to 120 per hour by hand rolling.

COST Approximately Rs. 6000

CONTACT AGENCY

The Managing Director
National Research Development Corporation
'Anusandhan Vikas
20-22, Zamroodpur Community Centre
Kailash Colony Extension
New Delhi 110 048.

PAPER SLATE BEING MADE

PAPER SLATE

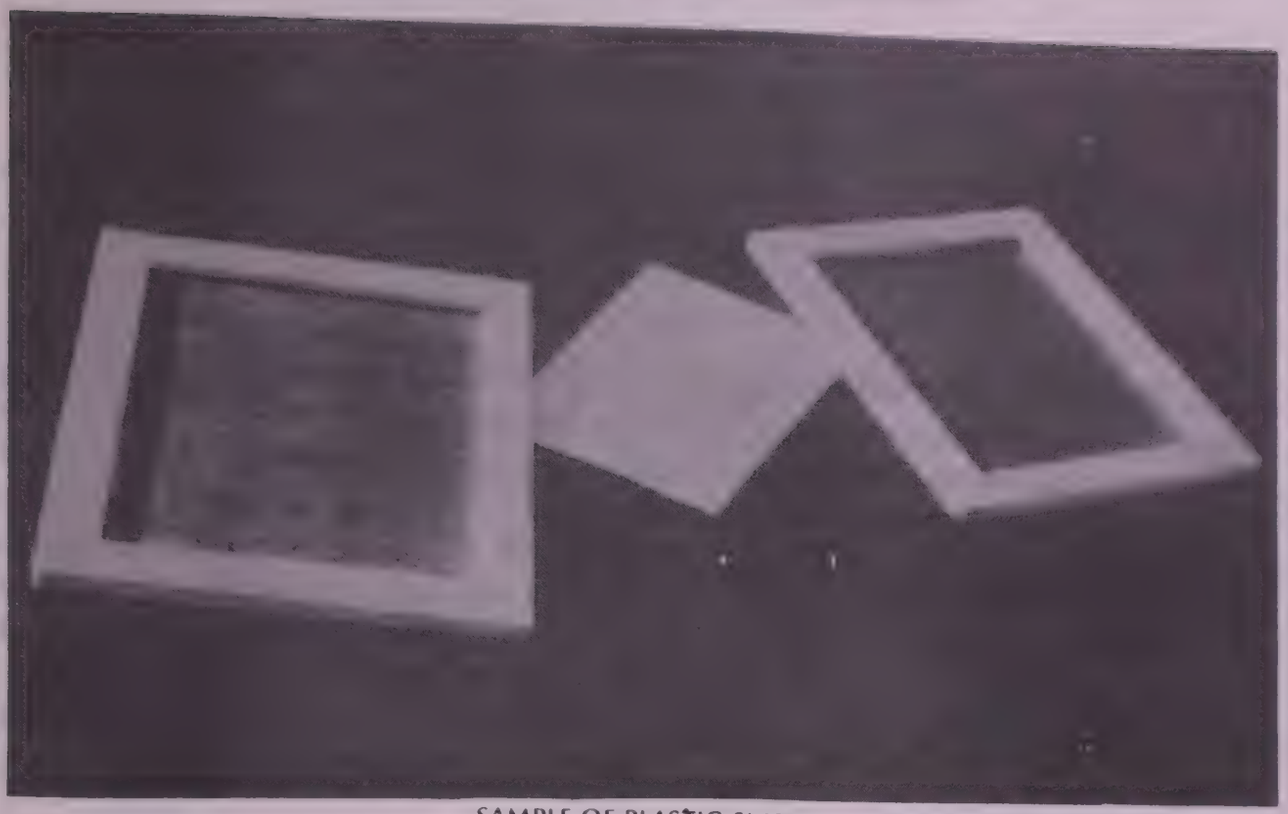
Paper slates are a superior replacement for conventional wooden or rock slates. Wooden slates lose their flatness and abrasiveness owing to constant use. The rock slate is heavy and breaks easily. The paper slate is light, durable and cheap and does not lose its abrasiveness easily. The Regional Research Laboratory, Jorhat, has developed a process for rendering paper-board of any kind water-proof by chemical treatment. The board is suitable for writing with ordinary slate pencil.

COST Rs 2/- per slate. Needs investment of only Rs. 15000 at cottage scale.

CONTACT AGENCY

The Director
Regional Research Laboratory
Jorhat 785 006, Assam

Telephone	Telex	Telegram
20353	0287-204 RRL IN	RESEARCH, Jorhat



SAMPLE OF PLASTIC SLATE

PLASTIC WRITING SLATES

Slates made of wood or rocky material are commonly used for writing by school-going children as well as by others attending adult education classes. While wooden slates lose their flatness and abrasiveness owing to constant use, rock slates are heavy and get broken easily. To overcome these problems, the Regional Research Laboratory, Jorhat, has developed a process for making plastic slates at cottage industry level. Plastic slates are plastic sheets with a suitable surface for writing with an ordinary slate pencil. The process comprises pressing plastic sheets of desired dimension in a hot press in the presence of certain chemicals. The sheets are framed by using frames of wood or other cheap framing materials. The process is simple and the manufacture can be on a small scale. Plastic slates are light and do not break easily. The attractive looks of such slates appeal to children and grownups alike.

COST For a unit with a capacity to produce 200 slates a day, capital of Rs 44,000 is needed. The production cost per slate comes to about Rs 2.25. Such a unit employs four persons.

CONTACT AGENCY

The Director
Regional Research Laboratory
Jorhat 785 006 (Assam)

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20353	0287-204 RRL IN	RESEARCH, Jorhat

PULSE AND PADDY DEHUSKER

This is an improved grinder and consists of two circular stones placed horizontally one over the other. The lower stone rotates and the upper one is stationary. The distance between the two stones is adjustable. Provision of a ball-bearing system to the lower stone makes the operation very light. Hopper is fixed to feed the cereals and pulses. Handle is prodded with the help of a long rod and fitted to the lower stone with a clamp. A stylus is also provided to displace the grains into the grinding stones. Paddy and pulses are lightly abraded by the grinding surfaces of both the stones. By adjusting the distance between the two stones, the dehusker can be used for both paddy and pulses. 80 kg of paddy or 25 kg of pulses can be dehusked in an hour. The grinding stone can be moulded with locally available stone grits.

COST Approximately Rs. 600.

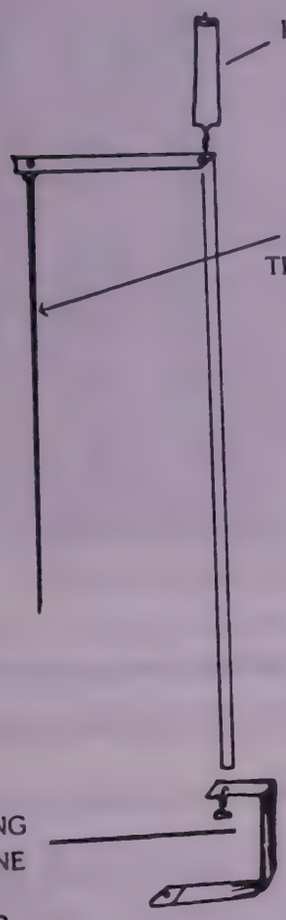
CONTACT AGENCY

J.B. Central Research Institute
Maganwadi
Wardha 442 001
Maharashtra

PULSE AND PADDY DEHUSKER

1

HOPPER



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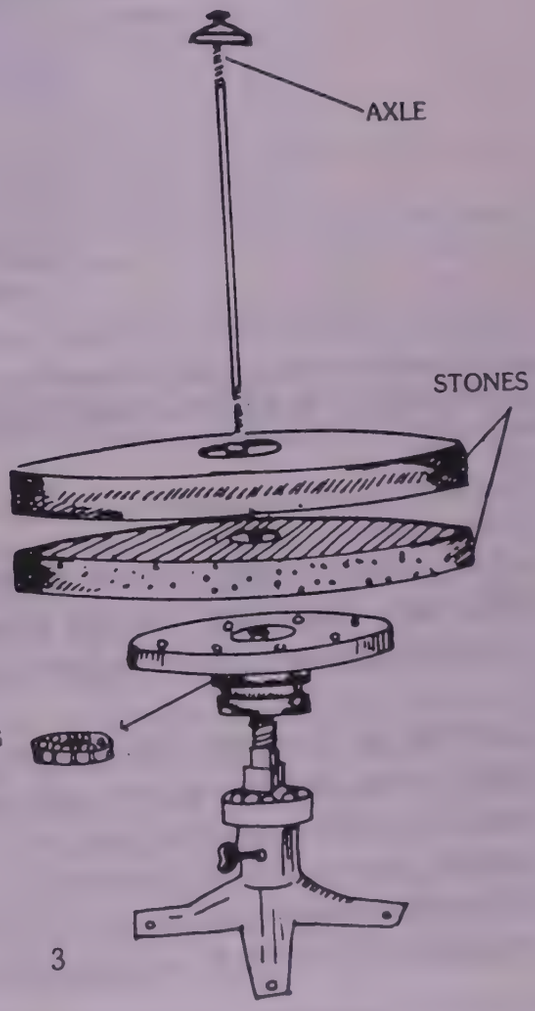

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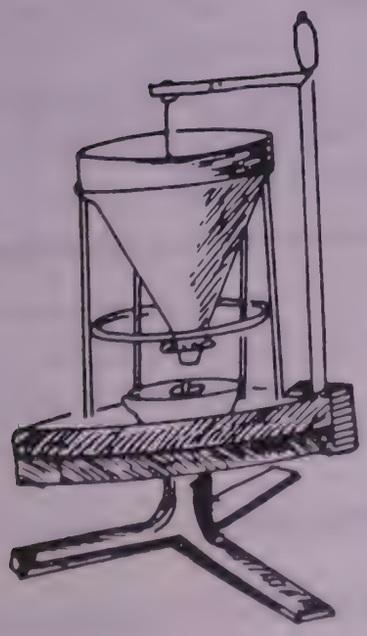

4

DEHUSKER

ROPE/SUTLI-MAKING MACHINE

ROPE/*SUTLI*- MAKING MACHINE

The rope has a variety of uses in everyday life and is made from different types of fibre like jute, flax, hemp, coir, and pineapples. The rope is usually made in villages manually in a laborious manner, involving a considerable amount of drudgery.

In order to eliminate the drudgery, to provide employment opportunities and to enhance the earning capacity of the rural population, a simple rope-making machine using easily available sewing machine parts and bicycle components has been designed. The machine can be operated by an operator sitting on a stool by simple pedalling as in a sewing machine. Its maintenance is easy. A person can produce 5-8 kg of rope per day by using the machine as against 500-700 g by the manual methods in vogue.

COST Rs. 800.

CONTACT AGENCY

The Managing Director
National Research Development Corporation
'Anusandhan Vikas'
20-22, Zamroodpur Community Centre
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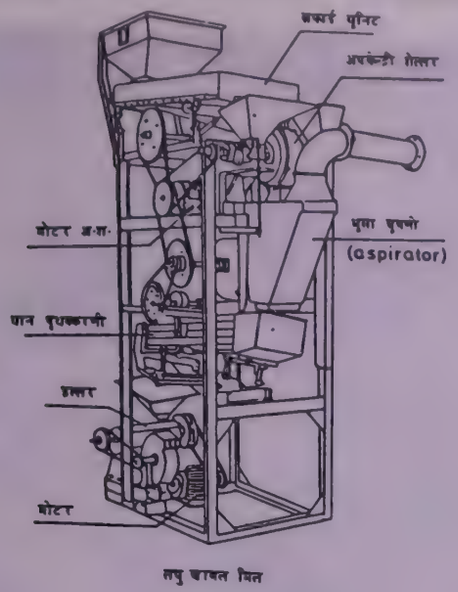
New Delhi 110 048.



MINI RICE MILL

MINI RICE MILL

The mechanized sector of rice milling industry handles more than 45 million tonnes of paddy annually. While 10-15 million tonnes are processed through large-scale modern mills, a major portion of the paddy is being processed through hullers.

It is necessary to exercise control over the yield of head rice which is now being lost as brokens. To prevent this, it is necessary to reduce the severity of the milling treatment, which in turn, could be accomplished by carrying out the shelling and polishing in two separate units. Keeping these factors in view, the Central Food Technological Research Institute, Mysore, has designed and developed a mini rice mill. This consists of a paddy cleaner, a sheller, a separator and a polisher. The separator is a compact unit designed on the densimetric classification principle. The polisher could be either a vertical cone polisher or a horizontal rotor polisher. Even a huller used for milling could serve as a polisher though there may be more breakage of rice. The mini rice mill gives 1-4% extra yield of head rice depending on the variety. It produces pure rice bran free from husk and enables control over the degree of polishing from 3% onwards. A capacity of 500 kg of paddy per hour is ideally suited to the rural sector as a small-scale venture. Paddy husk finds use as fuel and in making hardboards and activated carbon.

COST A 500 kg of paddy per hour (4 tonnes of paddy per day) capacity unit would need a capital investment on plant of Rs 50,000.

CONTACT AGENCY

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Mysore 570 013

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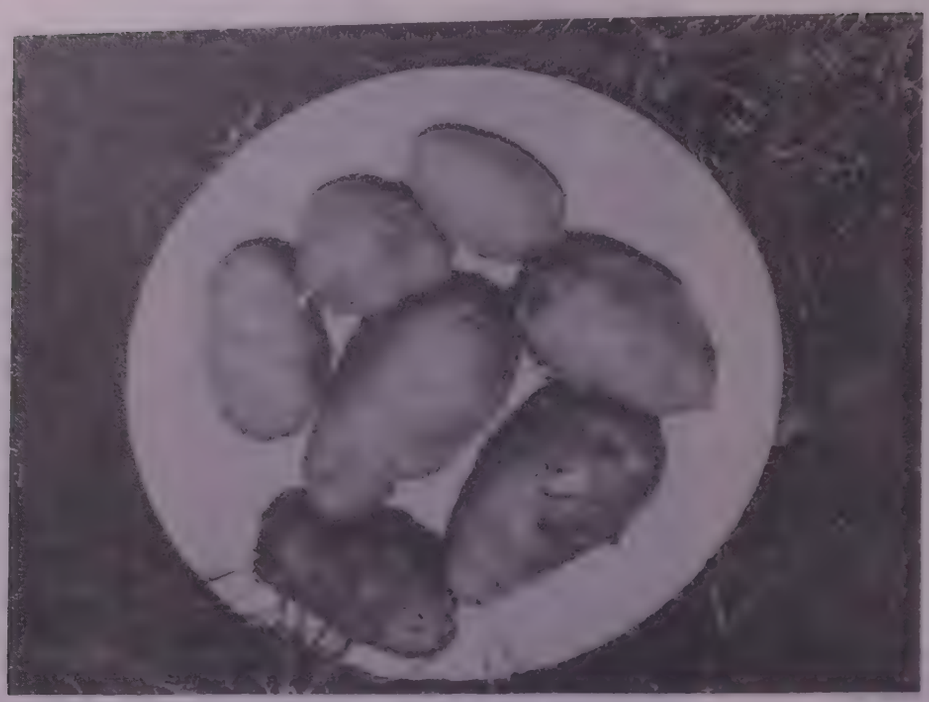

Potato

SUN-DRIED POTATO CHIPS

Potatoes are grown extensively in the northern region of India. During the glut season prices go down and the growers incur heavy losses. It is possible to utilize the surplus produce by preparing sun-dried potato chips on a hygienic basis.

Good-quality potatoes are washed, peeled, trimmed into strips or cubes or slices using stainless steel knives. The pieces are washed and dipped in water containing 0.12% potassium metabisulphite for 10-15 minutes and dried on mats or trays in dust-proof yards getting direct sunlight. The dried product is packed in polythene bags of suitable size.

The product is superior to the conventional one both in colour and quality. The process is simple and can be easily adopted.

COST An investment of about Rs 5,000 is needed to manufacture 25 kg of the product per day. The cost of production comes to Rs 13-15 per kg, with the cost of raw potato at Rs 1.50 a kg.

CONTACT AGENCY

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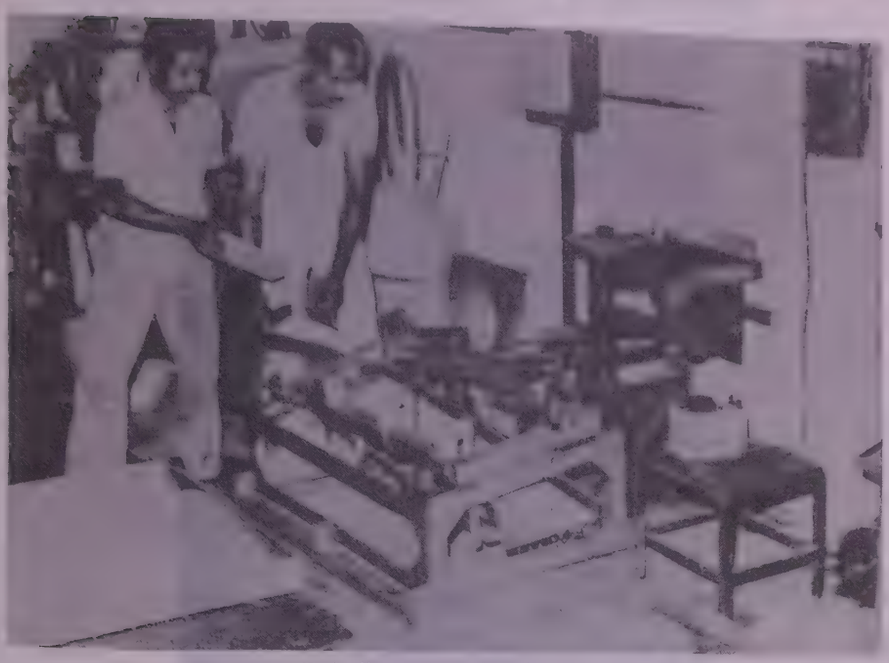
Central Food Technological Research Institute
Mysore 570 013
Telephone 20200
Telex 0846-241 FTRI IN
Telegram FOODSEARCH, Mysore



Dehulling of muskmelon seeds

DEHULLING OF MUSK MELON SEEDS

The seeds of musk melon, also commonly known as melon *(Cucumis melo)*, are rich in protein and fat. The kernels are used in baking and dressing bread, cake, confectionery; sweets and snack foods. They are also parched and eaten. A refreshing drink is prepared from ground melon seeds. The seeds are also a source of an enzyme and have medicinal uses. Large quantities of melon seeds are available in the country. They are normally collected by vendors and after manually dehulling are sold to retailers or wholesalers. Manual dehulling is tedious and time-consuming. Keeping this in view a simple process entailing a low investment for dehulling melon seeds has been developed by the Central Food Technological Research Institute, Mysore.

The process consists in preconditioning the seeds, dehulling, separating the fractions, recovering the kernels, drying the product and packing. The machinery/equipment used, namely a centrifugal sheller, a blower and a deck-type paddy separator, are indigenously available.

COST An investment of Rs 25,000 is needed to set up a plant with a capacity to dehull 100 kg of seeds per hour.

CONTACT AGENCY

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Mysore 570 013

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Fumigation of packed & processed food

FUMIGATION (MINIFUME) TABLETS

Grains and pulses during storage are prone to insect infestation and consequent damage, resulting in nutritional and economic losses to the consumer and trade. A simple, easy and safe method of disinfesting insect-infested foodgrains and pulses is now available as a result of the work of the Central Food Technological Research Institute, Mysore. One has to simply open the Minifume tablet and place it on top of the grain. It is kept for 6 days in a closed atmosphere, and then the container is opened to let the fumes escape for 3-4 hours. The container is now closed; the grain within is safe and free from any further damage. The technique is simple and safe.

COST For a plant of capacity 1,50,000 Minifume tablets per annum the estimated cost of plant and machinery will be around Rs 0.20 lakh. Minifume tablet is available at a very nominal cost of about Re. 1 per tablet. These tablets may be used in homes.

CONTACT AGENCY

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Central Food Technological Research Institute
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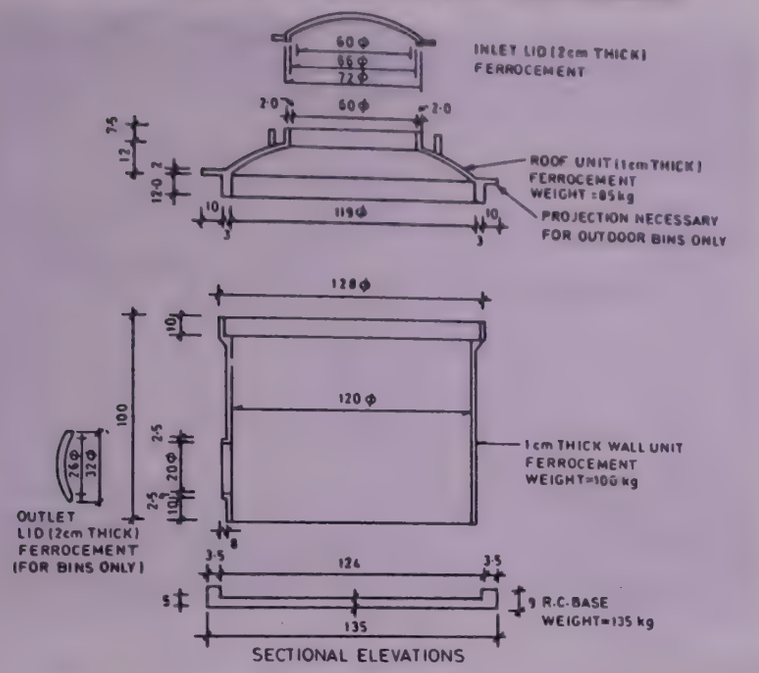

Drawings for prefabricated ferrocement units for storing food grains

FERROCEMENT GRAIN STORAGE BINS

FERROCEMENT GRAIN STORAGE BINS

The colossal losses of foodgrains taking place during storage could be avoided by providing scientific and inexpensive methods of storage at rural level. Ferrocement bins, of 0.25-, 0.5-, 1-, 2-, 3-tonne capacity, developed at the Structural Engineering Research Centre, Ghaziabad, provide a lasting solution to food grain losses.

Ferrocement is a highly versatile form of reinforced mortar consisting of closely spaced layers of wiremesh reinforcement impregnated with a rich cement-sand mortar. It is possible to cast ferrocement elements with a thickness of as small as 1 cm. Ferrocement possesses high resistance to cracking, and, unlike steel structures, has high corrosion resistance. It is cheaper than steel, reinforced concrete and aluminium bins of standard types. It is also lighter than conventional reinforced concrete bins. Condensation and moisture migration problems in food grains stored in ferrocement bins are much less than in food grains stored in steel bins. Rodent-proof, fire-proof and damp-proof, the bins can be made air-tight easily by sealing the inlet and outlet openings. The fabrication technology can be easily acquired by rural artisans.

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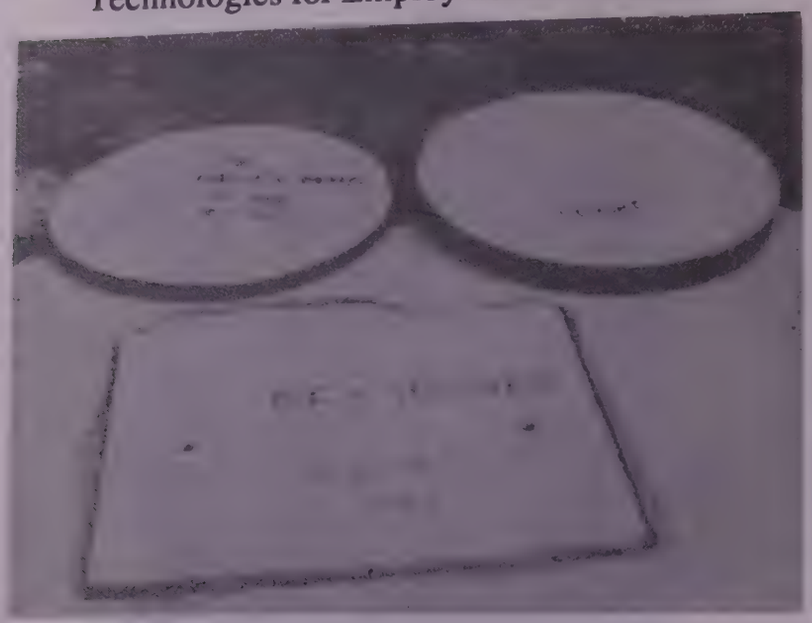

SAMPLES OF FERROCEMENT MAN-HOLE COVERS

FERROCEMENT MANHOLE COVERS

Cast iron manhole covers used at present for covering manholes of sewer lines, septic tanks, water lines or covered drainage lines are quite often stolen and a number of accidents have taken place (with manholes without cover). During handling or transportation or while in position, a large number of cast iron covers crack and there is no way through which these could be repaired. The Structural Engineering Research Centre, Madras, has developed light and medium-duty ferrocement manhole covers of rectangular and circular shape. Tests have shown that these covers can take loads specified for cast iron manhole covers.

Ferrocement manhole covers are about 25 per cent cheaper than cast iron manhole covers. These are free of the risk of theft. In case of any accidental damage, these can be easily repaired. Ferrocement covers could be produced at cottage industry scale in rural areas.

COST The unit for the production of ferrocement manhole covers can be started with an investment of Rs. 1.5 lakh,exclusive of the cost of land.

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FERROCEMENT SEPTIC TANK

The circular or rectangular septic tanks constructed with brick masonry are not 100% water-tight and require a large area. The effluent quality also deteriorates with time. If ferrocement is used as construction material in septic tanks, such tanks have the advantage of being impervious to water. The Structural Engineering Research Centre, Ghaziabad, has developed techniques for casting and assembling precast components of vertical, circular septic tanks. In the design adopted, the septic tanks are made of two precast units: (i) a sludge disgestion chamber, and (ii) a de-sludging pit. Ferrocement septic tanks are slightly cheaper than brick masonry septic tanks. Fully precast, transportable units can be produced to serve up to 25 users. It is ideal for use in rural areas, hilly areas and in areas where good-quality bricks are not available.

COST Cost Rs.950 for a family of 5 members.

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SUN-DRIED POTATO CHIPS

FRIED POTATO CHIPS

Deep fried potato chips are popular as a snack item, and are widely consumed and sold either loose or packaged. The snack is mainly manufactured on a cottage scale and it is possible to set up a small scale unit depending on the market outlet. Good quality, medium-size potatoes are washed in water, sliced with or without peel into 1.7 - 0.85 mm thickness and steeped in a solution containing salt, citric acid and potassium metabisulphite for about 10 minutes. The slices are partially dried and fried in refined oil, and excess oil is drained off. The slices are then sprinkled with a premix containing salt, spice powder, antioxidant and citric acid, mixed and packed in 200-250 gauge polythene pouches.

This product finds a ready market almost everywhere. Use of antioxidant retards rancidity and enhances the storage life of the product up to a month.

COST An investment of about Rs 7000 for a cottage-scale unit and Rs 2.5 lakh for a small scale unit may be required.

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DAIRY FARMING WITH CROSS BRED COWS

It is a cross between indigenous cows and exotic bull. The off-springs thus obtained are called 'Cross-bred Calves' and on first calving they are named "Cross-bred Cattle". The IVRI has got a cross between Haryana breed of Indian cow and Holstein Friesian American bull. The cross-bred cows of this type have potential of producing 3000 litres of milk in 300 wet -days. She remains dry hardly for three months. The first calving of cross-bred heifers comes in 24 to 28 months. These cows can give optimum milk production up to 10th lactation. She is fond of green fodder. That is why 5 litres of milk can be obtained from these cows with 40 kg of nutritious green fodders alone without feeding any concentrates. Roughly, the cost of milk production comes to Rs.2 per litre, depending upon the market and locality.

COST: The cost of rearing a female cross-bred calf upto the age of first calving approximately works out at Rs.4000 whereas the market price of a milking cross-bred cattle producing around 3000 litres of milk per lactation is about Rs.10,000 plus transport and other incidental expenses.

CONTACT AGENCY:

The Director
Indian Veterinary Research Institute
Izatnagar (Bareilly) 243 122, U.P.

GOATRY WITH IMRPOVED GOAT BREED

Goatry is a composite goat technology generated as a poorman's three-way business venture: milk, meat, and wool. Jamnapari is name of a goat which is famous for milk production. It can yield 130 litres of milk per annum. It matures in one year's time and starts producing milk within 14 months. She calves twice in 14 months. Black Bengal is a small goat famous for twins and trilets especially fit for meat production. Within 6 months of age, these goats can give 10 kg of meat. Chengu is a high altitude goat popular for Pashmina wool. She can produce about 400 grams of wool in one year. The feeding diet of goats is very simple. They can survive on grazing bushy and thorny shrubs like Babool and Jharber, grasses and leaf-tops. A herd of 5 Barbari or Jamnapari type of goats, if kept for milk productions can, generate a net profit of Rs.2194 per annum.

COST The price of an average goat is Rs.500. The price of a kid, however, is Rs.20 only.

CONTACT AGENCY

The Director
Indian Veterinary Research Institute
Izatnagar(Bareilly) 243 122,U.P.

PIGGERY WITH CROSS-BRED PIGS

Piggery is found to be a very remunerative business. Roughly, one cross-bred pig can generate a net profit of Rs.2000/-per annum provided the feed is supplemented with organic wastes and scavenges. Like cross-breeding in cattle, indigenous pigs are also crossed with exotic breeds like Yorkshire and Landrace. The cross-bred pig technology thus developed at IVRI can produce 10 to 12 piglets in one farrowing. The farrowing interval is 6 months. The piglets are weaned after 2 months and if they are provided with good nutrition they can gain a weight of 50 -60 kg at 6 months of age: the time when pig should be disposed of for slaughter.

COST One cross-bred pig of 50-60 kg weight costs about Rs.500. The piglet of 2-3 months age, however, can be made available at a cost of 200 to Rs.300 only.

CONTACT AGENCY

The Director
Indian Veterinary Research Institute
Izatnagar (Bareilly) 243 122,U.P.

HANDLOOM WITH DOBBY

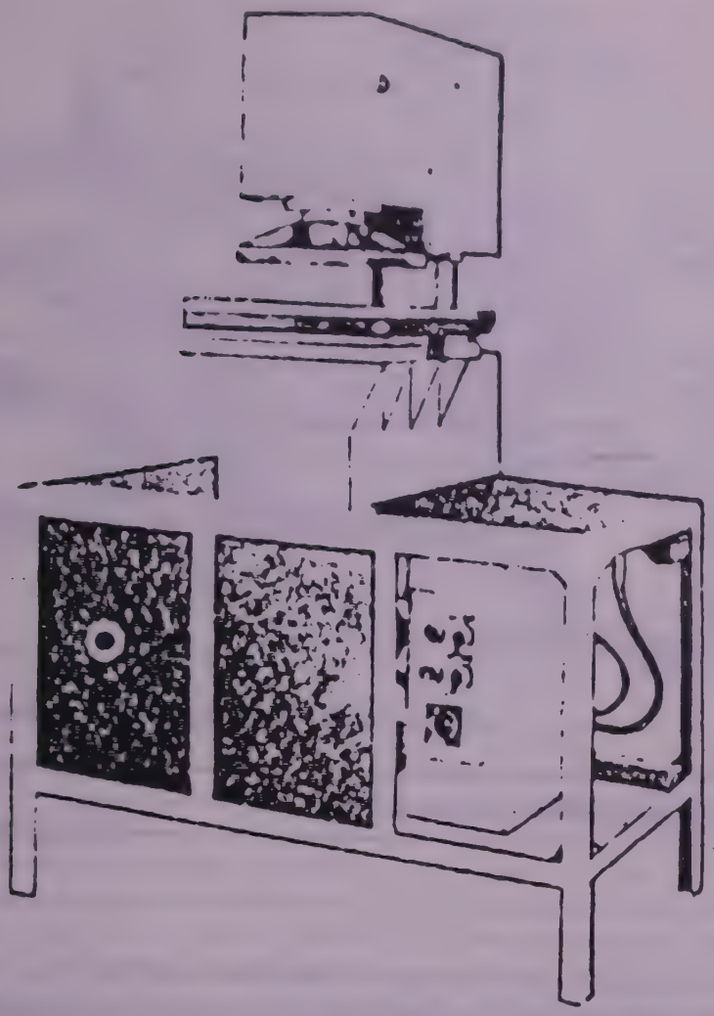
HANDLOOM WITH DOBBY

A modified handloom with dobby has been developed at R & D Centre of SASMIRA. The modification on the handloom can be easily adopted for weaving synthetic/blended fabrics. Take up motion device attached to the handloom helps in removing the defects in the weaving process and in getting evenness of picks. The dobby placed on top of the loom is a shedding device to produce a figured pattern by using a larger number of healds. In fancy weaving the dobby is used to produce small figures by means of warp threads and healds. Man-made fibre fabrics also retain their original gloss and finish for much longer period than any of the natural fibres. By producing high-value fabrics the handloom weaver can earn better returns for their labour. This process also helps in upgrading traditional skills and utilisation of more synthetic/blended fabric.

Cost Approximately Rs.7,500.

Contact Agency:

The Silk & Art Silk Mills Research Association
Sasmira Marg, Worli
Bombay 400 025
Telephone 493 5351
Telegram SASMIRA BOMBAY DADAR



HYDRAULIC CLICKER M-III

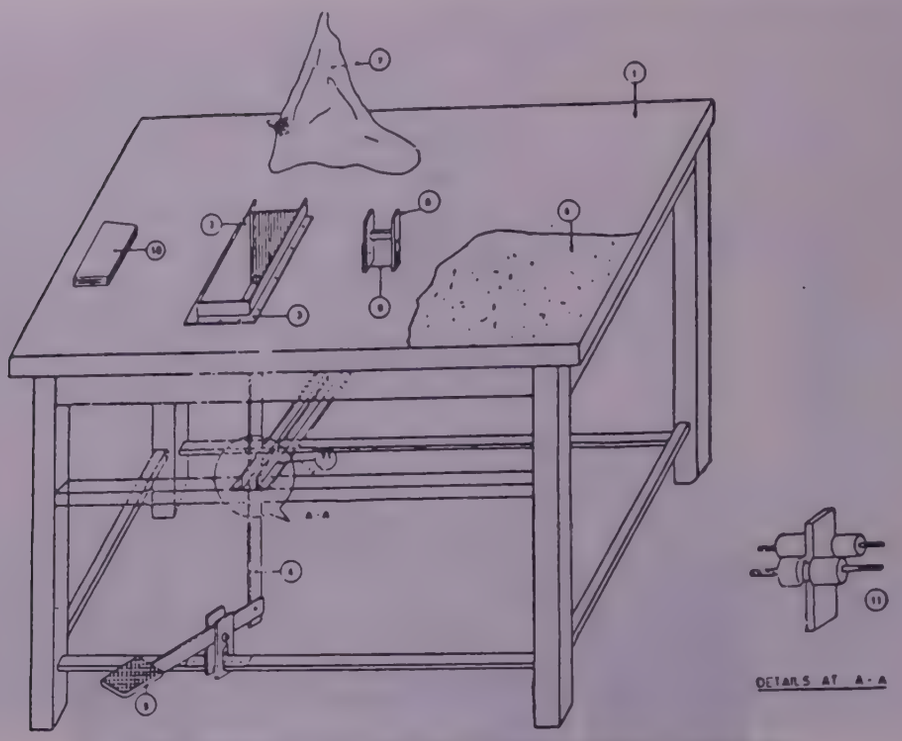
HYDRAULIC CLICKER M-111

It is used for cutting leather upper and other materials. It is highly productive, inexpensive machine fitted with 1.5 hp motor. It has a capacity of 16 tonnes.

CONTACT AGENCY

The National Small Industries Corporation Ltd.
"Laghu Udyog Bhawan", Okhla Industrial Estate,
New Delhi 110 020

Telephone	Telex	Telegram
637071	31-62131	SMALCORP, New Delhi



IMPROVED HAND MOULDING TABLE (ASSEMBLY DRAWING)

IMPROVED BRICK MOULDING TABLE

Brick moulding is a skilled job and for ages it has been carried out on ground by skilled moulders. However, the traditional and hereditary system of moulding is not producing bricks in numbers sufficient to keep pace with the increasing number of brick kilns. The Central Building Research Institute (CBRI), Roorkee, has therefore designed and developed a simple table for moulding bricks which helps improve brick quality and which can be used by any brick moulder of average skill.

It is a wooden table with a metallic/wooden mould fixed on it. The mould is provided with a movable mild-steel bottom plate which also carries the frog and is centrally attached to a vertical ejector shaft, actuated by a foot-operated lever mechanism.

COST The cost of the table with complete accessories like steel mould and ejector would be about Rs 450. Field trials have shown that a moulder with two helpers can mould about 1500 bricks a day.

CONTACT AGENCY

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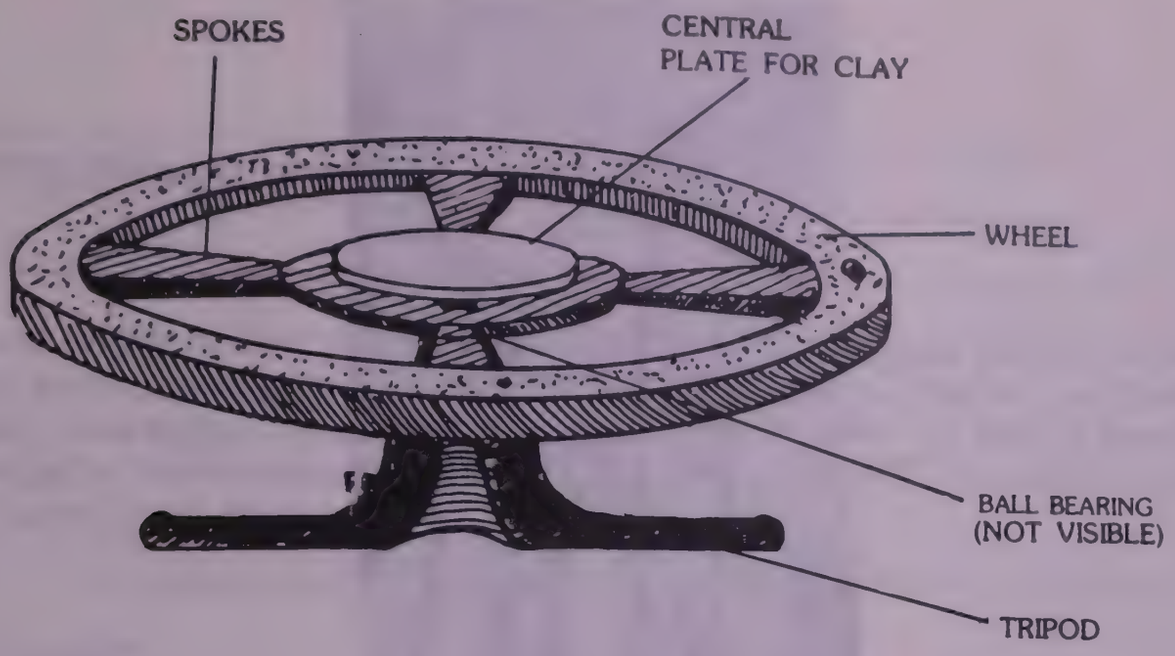

IMPROVED POTTER'S WHEEL

IMPROVED POTTER'S WHEEL

The traditional potter's wheel is heavy to operate and wobbles on the pivot. The improved wheel is safer and lighter to operate and rotates steadily. As a result the potter can increase production and enhance the quality of his products.

The improved potter's wheel has a tripod iron stand with a compact housing provision for two ball-bearings, MS rod and iron flange for the central part of the wheel. Wooden or iron spokes are provided for making the fly-wheel in the traditional way, either with clay or with cement concrete.

COST Rs. 350 for one wheel.

CONTACT AGENCY

Department of Pottery
Khadi & Village Industries Commission
Irla Road
Vile Parle (West)
Bombay 400 056
Maharashtra.

LEAF CUP MAKING MACHINE

LEAF-CUP MAKING MACHINE

Leaf cups and plates are made manually in villages. Used commonly for serving food at religious and social functions and for packing fresh edible items, these cups and plates are cheap, handy and clean and are easily disposable. The laborious craft of making leaf cups and plates has been transformed into a machine operation by the Central Food Technological Research Institute, Mysore. The Institute has developed a machine that makes the cups and plates in various sizes and shapes, the products being more uniform and of better quality than the ones made manually. It is because of these advantages that machine-made leaf cups/plates are being used at airport restaurants. The machine is manually operated. One can use dies of various shapes which are heated electrically or by a kerosene blow lamp. Various kinds of leaves such as those of *dak*, *kachnar*, *kela*, etc. can be used.

COST The machine costs Rs 5500 (Rs 4500 for the main machine and Rs 1000 for 2 sets of dies). An operator can produce about 250 cups/ plates in an hour from thin leaves and about 100 from thicker material.

CONTACT AGENCY

The Director
Central Food Technological Research Institute
Mysore 570 013

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LEAF-STITCHING MACHINE

The conventional method of stitching the leaf by hand is drudgery; and it is time-consuming for the workers, who are mostly women. A new leaf-stitching machine has been developed by Shri Trinath Sahu, of Orissa. With the help of this machine one can stitch 3 times more leaves than by the conventional method. It is simple to operate and economical to manufacture. Leaves of any shape or size can be used for stitching.

CONTACT AGENCY

The Managing Director
National Research Development Corporation
'Anusandhan Vikas'
20-22, Zamroodpur Community Centre
Kailash Colony Extension
New Delhi 110 048.

MUSSEL CULTURE

Of all the cultivable species of seafoods, edible bivalves--such as oysters, mussels and clams--are ideal for cultivation because they are sessile, filter-feeding, and highly tolerant to environmental changes, besides possessing prolonged breeding habits and a high growth rate. The spats of mussels, collected from their natural habitat, are transplanted and grown on hanging ropes suspended from floating rafts. The raft is made of a wooden frame and bamboos fixed on to four floating barrels and is moored by a steel anchor or a large stone. The initial investment is within the means of fishermen or poor folk interested in this activity.

COST The direct and indirect costs have been estimated to be Rs 1550 and Rs 900 per hectare respectively. Profit on the investment has been estimated to be Rs 4450 per hectare.

CONTACT AGENCY

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Vari VARIOUS STAGES OF MUSSEL CULTURE

NON-EDIBLE OIL AND SOAP INDUSTRY

One of the industries under the programme of Khadi and Village Industries Commission has been doing pioneering work to promote non-edible oils and soap industry since 1953 with a view to utilise the tree-borne oilseeds such as Sal, Neem and Mahua, which were going waste, for creating employment opportunities in rural and tribal areas. The collection of these non-edible oilseeds, processing thereof for oils and manufacture of laundry and toilet soaps using these non-edible oils are employment generation activities. The Government has placed emphasis on developing this industry, particularly in the villages in view of the ever-increasing gap between the production of vegetable oils and its demand for edible purposes as well as industrial purposes. The potential of production of oil from the tree-borne oilseeds is estimated to be about 10 lakh tonnes and that can replace equivalent quantity of edible oils for human consumption.

The availability of the minor oilseeds from perennial trees in the forests, road sides and other places is estimated to be about 67 lakh tonnes to yield about 10.23 lakh tonnes of oil and 13 lakh tonnes of oilcake. Training, technical know-how, guidance for marketing, quality control service and certification for tax exemption are the facilities extended to the units financed by KVIC. In case of toilet soap units, supply of standardised machinery and raw material is arranged by the Commission so as to ensure a standard quality product. Financial assistance is also given to registered institutions or cooperative societies for the following types of units: Collection of non-edible oilseeds, collection and crushing of non-edible oilseeds, laundry soap base, toilet soap base, and toilet soap. In case of laundry soap and toilet soap, assistance is also given to individual entrepreneurs through the State Boards only.

CONTACT AGENCY

Khadi and Village Industries Commission
"Gramodaya", Irla Road, Vile Parle (West),
Bombay - 400 056

PALM GUR INDUSTRY

The palm tree was known to man as a source of sweetening agent since time immemorial. The manufacture of jaggery, sugar, candy and other edible products or by-products from the sweet sap i.e. Neera, extracted from the four varieties of sugar-yielding palms and other fancy and utility articles from palmyra leaf, palm fibre and timber has been a traditional activity in South India and to some extent in West Bengal. The objective of the KVIC has been to properly organise and uplift the industry so as to improve the socio-economic conditions of the artisans vis-a-vis the production of valuable edible and non-edible items from palms which are otherwise going waste. The KVIC has also successfully adopted the open pan boiling technology for palm sugar making. The scheme has considerable scope for exploitation of palms and generation of employment in rural areas.

CONTACT AGENCY

Khadi and Village Industries Commission
"Gramodaya", Irla Road, Vile Parle (West),
Bombay 400 056

KARNATAKA FARMER SETTING HIS DEHYDRATION UNIT

DEHYDRATION OF FRUIT AND VEGETABLES

Fruit and vegetables are nourishing and protective foods, but are highly perishable. India produces 30 million tonnes of fruits and 22 million tonnes of vegetables annually, of which 25-30 per cent get spoiled at different stages. At present, only half a per cent of the horticultural produce is processed into various products.

Dehydration is one of the methods of preservation of food, including fruit and vegetables. In India, the dehydration industry is mainly concerned with processing potatoes, peas and, to some extent, some of the vegetables like cabbage, carrot, lady's finger, etc., to meet the needs of defence and catering institutes and establishments. The Central Food Technological Research Institute, Mysore, has standardized conditions for dehydration of different fruits and vegetables and packaging techniques to manufacture good quality products with prolonged shelf-life.

Mechanical dehydration can be carried out throughout the year as compared with the conventional way of sun-drying only in summer. Dehydrated fruit and vegetables are wholesome and convenient to use. As surplus produce of fruit and vegetables can be converted to dehydrated products, chances of spoilage are minimum. Horticultural produce ensures better returns to the grower. The industry is labour-intensive and has the potential to provide rural employment. The finished products have export market also and can be good foreign exchange earners.

COST A unit to manufacture 500 kg of dehydrated product per day needs an investment of Rs 8 to 8.5 lakh for equipment. The cost of 100 kg of the dehydrated product will come to Rs 600-800 prior to packing.

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LIME KILN CHARGING AT KVIC UNIT IN DEHRA DUN (U.P.)

SMALL-CAPACITY LIME KILN

Lime is the only building material, together with probably clay and stone, that has been finding use from the dawn of civilization. Although calcination of limestone to produce lime appears to be a simple chemical reaction, the process is beset with several difficulties. It is necessary to maintain the limestone at the required temperature for a certain period, as, in the absence of proper temperature control, the lime product would not be of uniform quality. It can be either overburnt or underburnt. In country-type and funnel-type *bhatties* which are commonly used for manufacturing lime, lime is not taken out continuously but is discharged in batches. As the fire rises from the bottom to the top during the firing cycle, the out going gases get very hot, have low thermal efficiency and controls being almost non-existent in such kilns. To put the traditional lime *bhatties* on a technologically sound ground, the Central Building Research Institute, Roorkee, has designed and developed efficient lime kilns of varying production capacity.

The kilns are made of brick or stone masonry structures. The designs ensure both smooth running and periodic withdrawal of lime. The kilns work on natural draft and have an arrangement for its control. They are thermally efficient, with heat losses being minimum, and produce uniform-quality lime, with no overburning or underburning of limestone. Contamination of burnt lime with fuel is minimized.

COST A small-capacity lime kiln (about 5 tonnes/day) costs Rs 85,000 only and requires a working capital of Rs 1,50,000.

CONTACT AGENCY

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UREA-MOLASSES LIQUID DIET (UMLD) FOR ANIMALS

Urea which for a long time is manufactured and sold as a nitrogenous fertilizer now can be used in ruminant feeds. It gets converted into protein in rumen bacteria. These bacteria are then digested in the digestive tract and the protein is thus made available to the animal. Similarly,molasses which is a by-product of sugarcane industry, gives energy to the animal and increases palatability of the feed.

The UMLD is mix of 68 grams of urea,144 grams of special concentrate,40 grams of mineral mixture, 28 grams of common salt, 20,000 units of Vitamin-A, and 720 grams of molasses.This mix is packed in polythene pouches (500 grams each)

One kg of UMLD after dissolving in 2 litres of water is mixed with 2 kg of wheat bhoosa + 1 kg of green fodder and is fed to the animals. The mixture of these ingredients is called "Sani". This Sani when given over and above the usual feed will either result in the increase of milk yield and/ or general health of the animals. The growing calves should be fed every day 0.50 kg concentrates + Sani. The word of caution is that UMLD should not be taken as an usual feed but as a special feed and, therefore, it should be fed only when the animal is under-fed and when there is scarcity of fodder or when there is occurrence of natural calamities like drought, floods and famine. Similarly, when there is enough of cereals + legumes mix fodder available, the feeding of UMLD-Sani should be avoided.

COST One kg of UMLD will cost about Re. 1 including packing.

CONTACT AGENCY

The Director
Indian Veterinary Research Institute
Izatnagar (Bareilly) 243 122, U.P.

NEEM-SEED CAKE : AN ANIMAL FEED

There are about 25 million neem trees in India found almost in every village. Its seed called "Nimboli" is rich in protein. The cake produced from these nimbolis after decortication contains 35-40% of protein which is comparable to other commonly used cakes like groundnut cake and mustard cake. Besides protein, neem seed cake is rich in carbohydrates and minerals. Therefore, neem-seed cake is a good protein-rich animal feed.

However, this cake when fed as such to the animals is unpalatable and harmful because of a large number of toxic compounds,bitter taste and foul-smell. A technology has been developed to overcome not only its bitter taste and foul smell but also to remove its toxic compounds.

The technology developed at IVRI is to soak one kg of neem-seed cake in 15 litres of water, keep it overnight, and then filter in the morning. Wash it again three times with fresh clean water and then dry in the sun. By this method, toxic substances, bitter taste, and foul smell disappear and the cake thus becomes palatable. It can then be fed with other feed ingredients to the animals. Following formula is recommended to prepare a concentrate mixture for cattle and buffaloes.

Water washed neem seed kernel cake = 40 per cent; Maize = 30 per cent; Wheat bran = 27 per cent; Mineral mixture = 2 per cent; Common salt = 1 per cent

COST Approximately Rs.1.50 per kg.

CONTACT AGENCY

The Director
Indian Veterinary Research Institute
Izatnagar (Bareilly) 243 122,U.P.

PICTURE SHOWS CATTLE LICKING THE MINERALIZED SALT BLOCKS — (CSMCRI, BHAVNAGAR).

MINERALIZED SALT LICK FOR CATTLE

Apart from common salt, cattle require some trace minerals and elements which are essential for maintaining their health and other physiological balances, especially milk quality and quantity. An artificial salt lick containing trace minerals in suitable quantity would be an ideal solution. Towards this end the Central Salt & Marine Chemicals Research Institute(CSMCRI), Bhavnagar, has developed a technology to prepare both mineralized and plain (common salt) cattle lick blocks.

Common salt is ground to about 100 B.S. mesh and is mixed with finely powdered calcined magnesite and magnesium chloride solution containing sufficient amounts of mineral salts. The paste is properly mixed and transferred into wooden moulds. It is manually pressed with a wooden hammer and allowed to set for few hours. After proper setting, the moulded salt block is removed and cured in the sun for 8-10 h. The cattle lick block supplies trace elements and minerals which are otherwise not available to cattle. Simple to make, the cattle licks can be produced on a cottage scale.

COST The capital investment for preparing the mineralized cattle lick at the rate of 200 blocks a day has been estimated to be Rs. 1.02 lakh. The capacity of a minimum economically viable unit has been worked out to be 60 licks per day.

CONTACT AGENCY

The Director
Central Salt & Marine Chemicals
Research Institute
Bhavnagar 364 002, Gujarat

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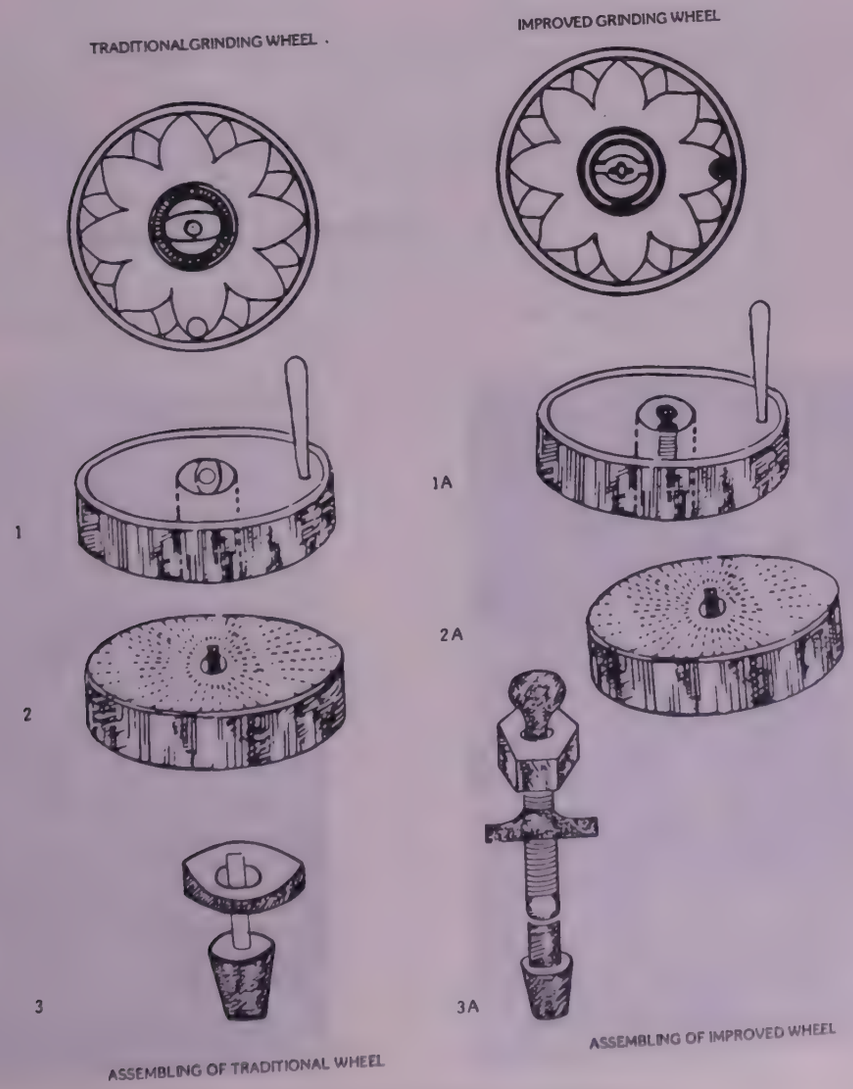
24496	0182-230 SALT IN	NAMAK Bhavnagar

IMPROVED STONE GRINDER

A single steel ball-bearing is introduced into the traditional stone grinder *(chakki)*. The weight of the upper grinding stone is transferred to the pivot. These changes would bring about considerable improvement by reduction in friction losses.

The improved grinding system consists of an iron pivot with a concave cavity. A steel ball fits into the cavity. The functional efficiency of the traditional wooden collar of the upper stone is increased by fitting it with a screw device. The screw with the stone fits on the top of the ball in the pivot. Since the entire weight is shifted to the ball-pivot, the upper stone rotates smoothly, minimising friction.

Grain is poured in through the space around the top screw. The gap between the two stones can be adjusted according to requirements of grain processing.



IMPROVED STONE GRINDER

COST All components for the new arrangement would cost about Rs. 40/-.

CONTACT AGENCY

Department of Cereals and Pulses Industries
Khadi & Village Industries Commission
Irla Road
Vile-Parle (West)
Bombay 400 056
Maharashtra.

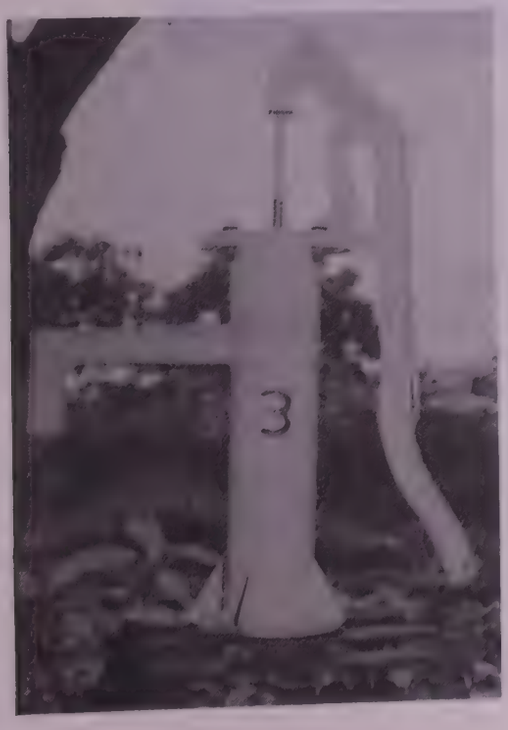
SHALLOW WELL HAND PUMP

The development of an improved shallow well hand pump has been identified as a project of national importance by the National Drinking Water Mission for community water supply. Though a number of pumps are currently manufactured and are in vogue, they do not conform to standard specifications to permit interchangeability of parts. They are also of poor quality because of inferior input materials and other defects. An improved shallow- well hand pump has been developed by MERADO under the sponsorship from the Department of Rural Development, Union Ministry of Agriculture. The salient features are: its depth of operation is 7 metres; it requires minimum effort; it is corrosion - resistant and its wear and tear is low.

COST Rs. 1000

CONTACT AGENCY

Scientist Incharge
Mechanical Engineering Research & Development
Organisation, (MERADO Centre)
CSIR Madras Complex, TTTI-Taramani,
Madras 600 113



FERROCEMENT WATER STORAGE TANKS

Providing drinking water to rural areas is a challenging problem despite the fact that the Government of India have accorded top priority to this problem. Safe storage of water so as to maintain its quality is an equally important problem. Economical and light-weight ferrocement water tanks of capacities ranging from 270 to 20,000 litres have been developed at the Structural Engineering Research Centre.

Ferrocement is a highly versatile form of reinforced mortar consisting of closely spaced layers of wiremesh reinforcement impregnated with a rich cement-sand mortar. It is possible to cast ferrocement elements with a thickness of as small as 1 cm. Ferrocement possesses high resistance to cracking, and, unlike steel structures, has also high corrosion resistance.

Unlike steel water tanks these are free from corrosion effects. Are lighter than RCC water tanks and consume less cement and steel. Could be easily repaired when accidentally damaged. All sockets for inlet, outlet, overflow and scouring pipes are fitted during casting itself. Tanks could be erected underground, on ground, or as overhead tanks.

COST Rs. 0.50 per litre of capacity.

CONTACT AGENCY

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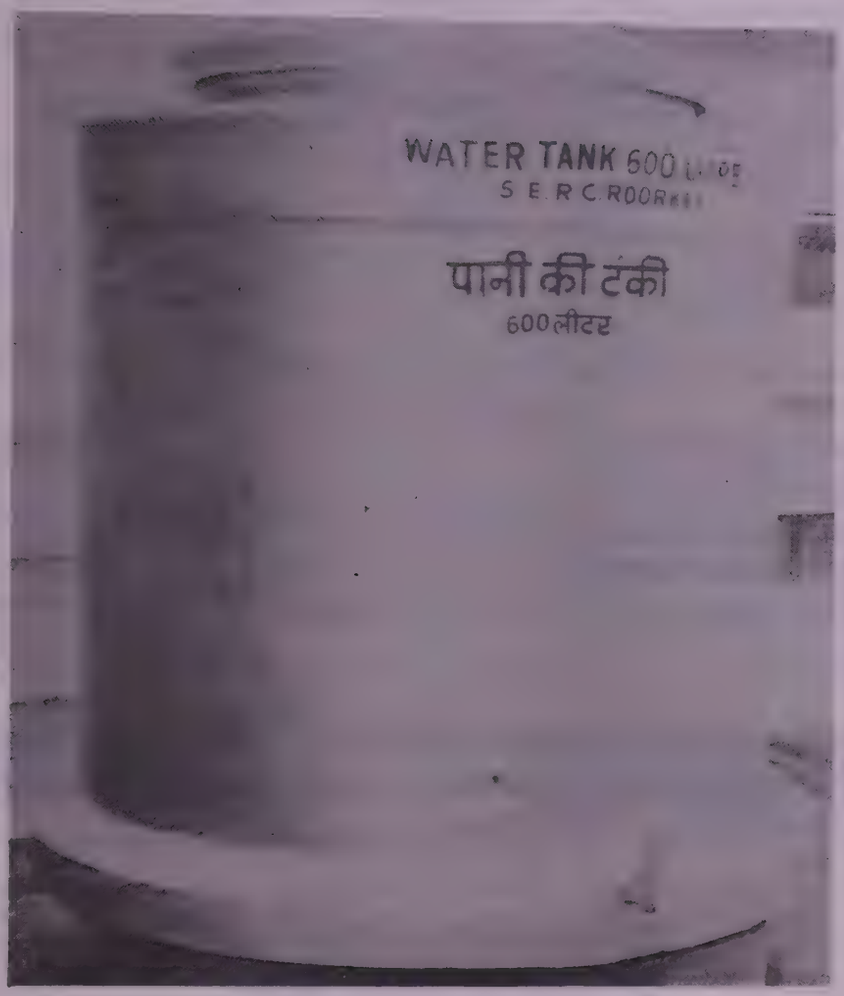
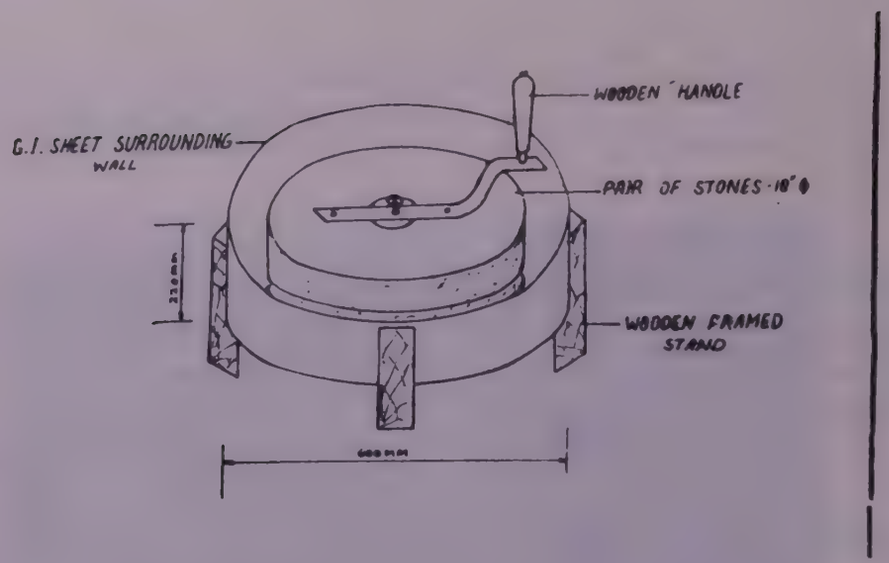


FERROCEMENT WATER-STORAGE TANK



IMPROVED HAND CHAKKI

IMPROVED HAND *CHAKKI* (MILL)

The basic design of the *chakki* is based on the two-stone grinding method. It has a grinding capacity of 3 kg of wheat flour/h or 5 kg of wheat dalia/h. It can be adopted by every family in the rural sector. Its anticipated life is 20 years.

COST Rs. 180.

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III TECHNOLOGIES AND PRACTICES FOR HIGHER AGRICULTURAL YIELD AND INCOME

A. CULTIVATION OF NON-CONVENTIONAL CROPS FOR HIGHER INCOME

CULTIVATION OF BELLADONNA

Belladonna comprises dried leaves and roots of the plants *Atropa belladonna* Linn. and *Atropa accuminata* Royle. It is one of the most important plant drugs used in modern medicine. The drug is used in a number of formulations, both in the form of crude extract and pure alkaloid because of its mydriatic, sedative and antispasmodic properties. The Central Institute of Medicinal and Aromatic Plants, Lucknow, has developed the agrotechnology of the plant for cultivation in Kashmir.

Balladonna is rich in hyoscyamine. It is a suitable crop for regions with temperate climate. The cultivation of belladonna is economically viable, yielding profit for three years.

Atropa belladonna (Belladonna)

COST An income of Rs 7600 per hectare is obtained every year when roots and leaves are sold at the rate of Rs 5 and Rs 10 a kg respectively.

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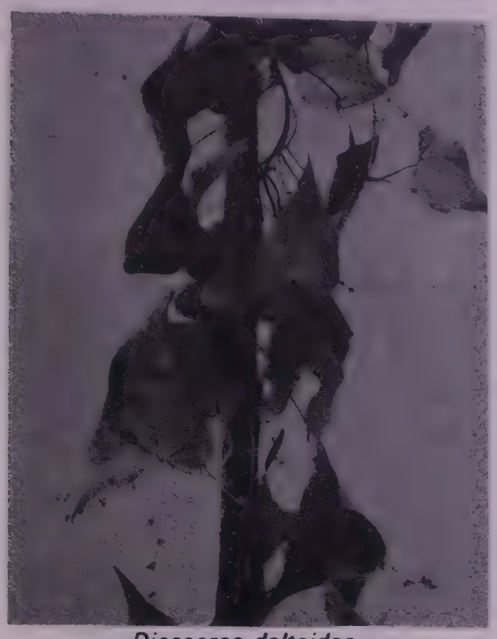

Dioscorea deltoidea

CULTIVATION OF *DIOSCOREA DELTOIDEA* FOR DIOSGENIN

Rhizomes of *Dioscorea deltoidea* Wall contain a chemical called diosgenin which is a raw material for the synthesis of a number of steroidal drugs, e.g. corticosteroids, anabolic steroids, sex hormones and oral contraceptives. In India, the plant is found growing wild in north-western Himalayas, Jammu and Kashmir, Himachal Pradesh and Uttar Pradesh and is the main source of diosgenin. In order to ensure the continuous supply of the raw material, the Central Institute of Medicinal and Aromatic Plants, Lucknow, has developed the agrotechnology of the plants.

Medium loam deep soils which are rich in organic matter are ideal for its cultivation. The plant tolerates a wide range of pH but highly acidic and highly alkaline soils should be avoided. It grows well in temperate climates. The plant rhizome is a good source of diosgenin. The cultivation of the crop is economically viable. The plant is suitable for cultivation in the temperate climatic zones of India.

COST An income of Rs 12,000 per hectare is obtained after a period of three years when the selling price of the tuber is about Rs 6 a kg.

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Dioscorea floribunda

CULTIVATION OF *DIOSCOREA FLORIBUNDA* FOR DIOSGENIN

In India, there is a great demand for diosgenin which is a raw material for the synthesis of a number of steroidal drugs,e.g. corticosteroids, sex hormones, oral contraceptives and anabolic steroids. The present source of diosgenin in the country is the rhizome of *Dioscorea deltoidea*, which is found growing wild in north-western Himalayas, Jammu and Kashmir, Himachal Pradesh and Uttar Pradesh.

As this plant is limited to higher altitudes, it was thought imperative to introduce a plant that is suitable for cultivation in the subtropical plains of north and central India. The Central Institute of Medicinal and Aromatic Plants, Lucknow, introduced a Mexican plant, *Dioscorea floribunda* Mart. and Gal. and developed its agrotechnology for the northern and central plains. The plant rhizome is a good source of diosgenin. The cultivation of the crop is economically viable. The plant is suitable for cultivation in the plains of north and central India.

COST An income of Rs 12,000 per hectare is obtained after a period of two years when the selling price of the tuber is about Rs 5 a kg.

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Pelargonium graveolens (Geranium)

CULTIVATION OF GERANIUM FOR OIL

Geranium oil is obtained by steam distillation of leaves and branches of *Pelargonium graveolens* Linn. 'Herit'. The oil is widely used in soap, perfumery and cosmetic industries. Though the oil is being produced in the country, the production falls far short of the requirements. As a result, it is being imported. The agrotechnology for the culture of geranium has been developed by the Central Institute of Medicinal and Aromatic Plants, Lucknow.

It flourishes best in the Mediterranean - type of climate with low humidity, and mild summer temperature having an annual rainfall between 1000 and 1500 mm. The hills of Shevaroy, Palni, Nilgiris and Annaimalai are ideal for its growth. The crop can also be cultivated in the Karnataka State. It is an economically viable crop. It is a continual crop and gives returns up to four years. It yields valued perfumery oil.

COST A yield of 18 kg of oil is obtained from a hectare crop annually. A net profit of Rs 12,000 per hectare per annum is obtained when geranium oil is sold at Rs 1000 a kg.

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Mentha arvensis (Japanese Mint)

CULTIVATION OF JAPANESE MINT FOR MINT OIL AND MENTHOL

Japanese mint oil is obtained by distillation of leaves or whole plant, *Mentha arvensis* Linn. The oil represents the best source of menthol which is used in the pharmaceutical, the flavouring and the perfumery industries. The oil itself finds use in the flavouring industry. The Central Institute of Medicinal and Aromatic Plants, Lucknow, has developed the agrotechnology of the plant.

A new strain, called CIMAPMAS-I, has been developed which contains 0.8-1% of oil as compared to 0.4-0.6% oil in the earlier cultivated strain. The menthol content in the new strain varies between 81 and 85 per cent - from which 65 per cent of menthol can easily be recovered by chilling as compared to 40 to 45 per cent from the earlier cultivated strain. The mint oil is rich in menthol. Yields of herb and oil per hectare are high. It is a short duration crop and is economically viable.

COST An average yield of 75 kg mentha oil per hectare, is obtained in a period of eight months. An income of Rs 7500 per hectare is possible if the oil is sold at the rate of Rs 100/kg.

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Cymbopogon winterianus Jowitt (Java citronella)

CULTIVATION OF JAVA CITRONELLA FOR OIL

The oil is obtained by distilling the leaves of the citronella plant *Cymbopogon winterianus* Jowitt. The oil is a source of important perfumery chemicals like citronellal, citronellol and geraniol that find extensive use in soap, perfumery, cosmetic and flavouring industries. The agrotechnology of the crop has been developed by the Central Institute of Medicinal and Aromatic Plants, Lucknow.

Citronella thrives well under tropical and sub-tropical conditions. It needs abundant moisture and sunshine for good growth. Sandy loam soil with abundant organic matter suits most for its cultivation. The oil is a rich source of perfumery chemicals. The plant can be grown successfully in tropical and sub-tropical climatic regions. It is an economically viable crop. The cultivation does not need high inputs. Once planted, the plant continues to thrive for four years.

COST Under very favourable conditions, a yield of 200-250 kg oil per hectare can be obtained. On an average, an income of Rs 6000 per hectare a year is possible

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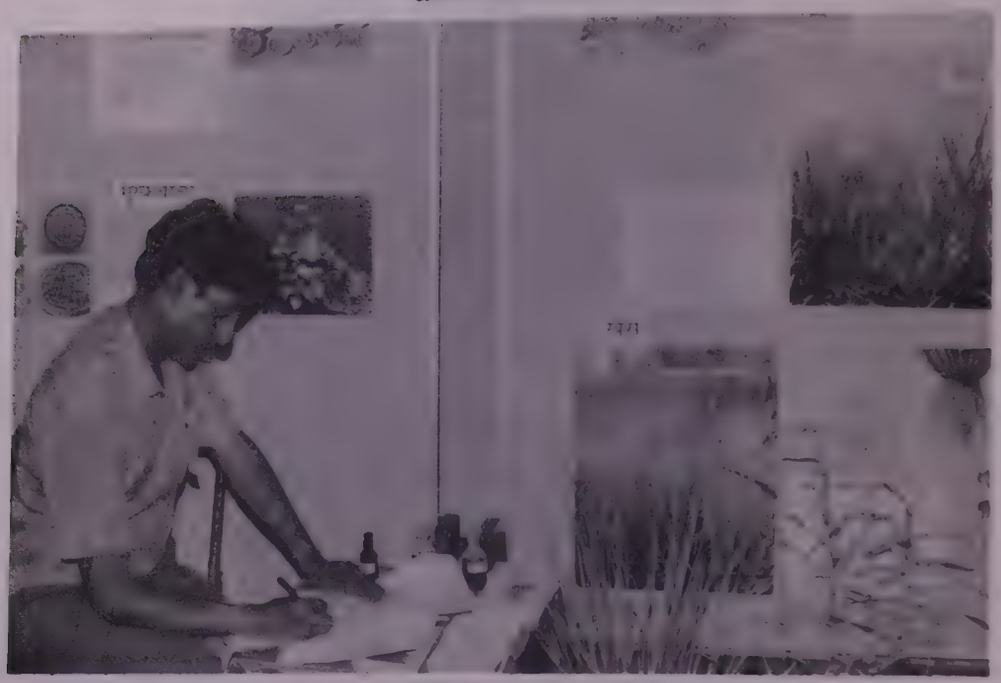

LEMONGRASS

CULTIVATION OF LEMONGRASS FOR OIL

The leaves of the lemongrass plant, on distillation, yield lemongrass oil. The oil is an important source of citral, a raw material for the synthesis of vitamin A and for the manufacture of ionones and a number of aromatic compounds. The oil is also used in flavours, cosmetics and perfumes. A good amount of foreign exchange is earned through its export.

Lemongrass requires a warm and humid climate with plenty of sunshine and rainfall. High temperature is conducive to the development of oil in the plant. It flourishes on a wide variety of soils ranging from rich loam to poor laterite. However, it grows best on well-drained sandy loam soil. The oil is rich in citral content. It is a salt-tolerant crop and can be grown on soils with pH 7.8. The lemongrass crop gives profits up to four years. It could be grown on undulated fields, provided the rainfall is regular and is evenly distributed.

COST Usually, 75-100 kg of lemongrass oil per hectare is obtained in a year. If lemongrass oil is sold at the rate of Rs 70 a kg, a net profit of Rs 2800 per hectare is made in a year.

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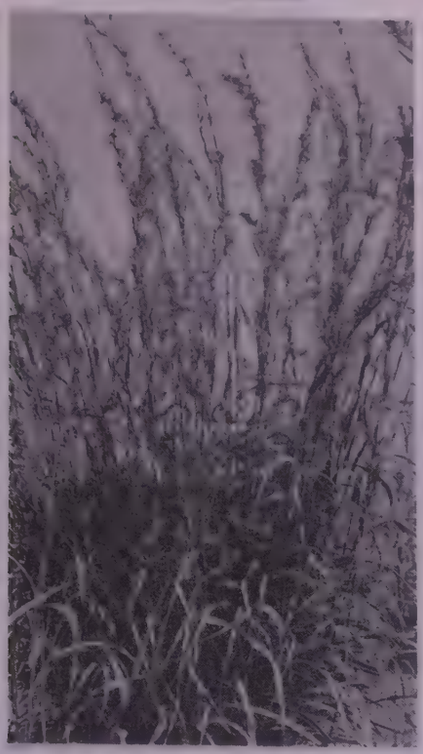

Cymbopogon martinii (Palmarosa)

CULTIVATION OF PALMAROSA FOR OIL

The essential oil of palmarosa is obtained by distillation of overground parts of the plant, *Cymbopogon martinii* var. *motia*. Palmarosa oil is used in perfumery, particularly for flavouring tobacco and blending soaps. It is also a source of very high-grade geraniol.

A well-drained fertile loam to sandy loam soil with an annual rainfall of about 150 cm is ideal for its cultivation. It is an economically viable crop. It can be grown in salt affected soils with pH up to 9.8. Waste land can also be utilized for cultivation. It is a continuing crop, giving incomes up to four years. Its cultivation does not need high inputs.

COST On an average, a palmarosa crop gives a profit of about Rs 3000 per hectare in a year when the oil price is Rs 140 a kg.

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CULTIVATION OF PEPPERMINT FOR OIL

Peppermint oil is obtained from the whole herb, *Mentha piperita* Linn. The oil is used in the flavouring and the pharmaceutical industries. Although a considerable quantity of the oil is being produced in India, peppermint oil is still being imported to meet the needs of industry. The Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow, has developed the agrotechnology of the plant's cultivation in sub-tropical and temperate regions.

The earlier strain could grow only in lands with a temperate climate. A mutant strain has been evolved by CIMAP at Lucknow. It is well suited to the sub-tropical areas of North India. In contrast to the parent clone, the mutant has broader leaves and an erect habit with 30-35 per cent more herb in the sub-tropical areas of India. The ideal yield is obtained only in temperate climatic conditions prevailing in Kashmir, Kumaon Hills of Uttar Pradesh and the hilly regions of Himachal Pradesh. The cultivation is economically viable. It is a new exotic crop. Its culture results in saving of foreign exchange. The crop lasts three years.

COST A yield of about 50 kg of oil per hectare is obtained in a year. A net income of Rs 7000 per hectare is obtained if the oil is sold at Rs 200 a kg.

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Mentha piperita (Peppermint)

CULTIVATION OF PERIWINKLE

The roots and leaves of the plant, *Catharanthus roseus* Linn. G. Don (common name, periwinkle) are of much use in medicine. The leaves are a source for vincristine and vinblastine which are anticancerous drugs. The roots provide raw material for ajmalicine (raubasin), an antifibrillic agent. Most of the raw materials for getting these alkaloids were earlier being obtained from wild sources particularly from South India. The Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow, has now developed the agrotechnology for cultivation of the plant.

The plant has no particular soil or climatic needs. However, the growth of the plant is much better in tropical areas and states like Tamil Nadu, Karnataka, Andhra Pradesh, Gujarat, Madhya Pradesh and Assam, which are ideal for cultivation of the crop. The plant also grows in sub-tropical areas of northern India, but the growth is slow owing to low temperatures during winter.

The plant yields an important drug which has international demand. It is a drought-resistant crop. It is a very hardy crop that does not need much care. The plant adapts to a wide range of climates.

COST Under irrigated conditions, an income of Rs 5000 per hectare is possible, whereas under rainfed conditions an income of Rs 2000 could be made per hectare.

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Catharanthus roseus (Periwinkle)

Chrysanthemum cinerariaefolium (Pyrethrum)

CULTIVATION OF PYRETHRUM

Pyrethrum is dried flower heads of the plant, *Chrysanthemum cinerariaefolium* Vis., which is a useful insecticide for control of household insects and protection of foodgrains. Because of its very low mammalian toxicity, it is the safest insecticide. An improved agrotechnology has been developed for the cultivation of the crop by the Central Institute of Medicinal and Aromatic Plants, Lucknow. The Kashmir Valley and Himachal Pradesh in the north and Nilgiris and Palni hills in the south are the only suitable places for cultivation of the crop. It is widely used and the safest insecticide. It is an economically viable crop. Continues to give income for a period of three years.

COST Yearly income of Rs 1000 per hectare is obtained in Kashmir, whereas it is about Rs 4000 down south in the Nilgiris.

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Rosa damascena

CULTIVATION OF ROSE AND PRODUCTION OF OIL

Rose oil, obtained from *Rosa damascena*, is considered to be the best perfumery oil. It is being produced in Bulgaria, USSR, Turkey and Morocco. In India, the crop is being cultivated on a large scale in Uttar Pradesh, mainly in district Aligarh. The Central Institute of Medicinal and Aromatic Plants, Lucknow, took up a project and set up a plant of 25 kg flowers/batch in village Hasayan, District Aligarh. The yield of oil obtained was 0.018% and the quality of oil was found to be on par with that of the Bulgarian rose oil. The process was scaled to 125 kg flowers per batch. During March 1983 an average yield of 0.02-0.03% oil was obtained. The recovery of oil with this improved processing technology for rose flowers was more than 4 times the oil obtained with the use of country-made stills. The technology has been transferred to the Agra Mandal Vikas Nigam Limited, Agra (UP) for commercial production.

COST The net return per hectare under *Rosa damascena* cultivation would be about Rs. 20,000, on the basis of flower price of Rs. 15/kg.

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Rauvolfia serpentina L. (Sarpgandha)

CULTIVATION OF SERPENTINA ROOT

The dried roots of the plant *Rauvolfia serpentina* Benth. ex Kurz are used in modern medicine as an antihypertensive and sedative. The agrotechnology of the crop has been developed by the Central Institute of Medicinal and Aromatic Plants, Lucknow.

The plant grows on a wide variety of soils. Acidic and neutral soils are better. The plant does not grow well in soils with pH 8. Although the plant has been cultivated in all types of climatic regions, tropical areas with enough rainfall are, however, best suited for the plant. It can be grown in open and partial shade. It can also be grown as an inter crop in orchards. The culture of the crop is economically viable.. It needs less care agriculturally.

COST The yield of roots is 1000 kg per hectare after a period of two years. A profit of Rs 12,500 per hectare is obtained after a gap of two years.

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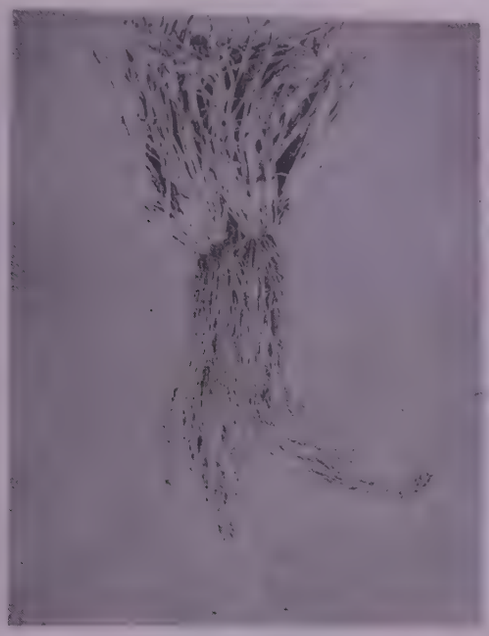

Vetiveria zizanioides

CULTIVATION OF VETIVER FOR ESSENTIAL OIL

Roots of vetiver *(Vetiveria zizanioides)*, on distillation, yield an essential oil, vetiver oil. The oil is used extensively in perfumery, as a fixative. Vetiver can be cultivated in tropical and sub-tropical climates. It grows under high-humidity and high-temperature conditions. The vetiver growth is maximum in sandy loam soils rich in organic matter. It can, however, be grown in a variety of soils ranging from normal to saline and alkaline, sandy to clayey and water-logged to dry. The growth and root development are better in loamy clay soils, but the cost of digging is very high. The Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow, has developed a new strain of vetiver (from its Bharatpur selection), which gives higher yields than the existing strains. Vetiver oil is used as a fixative in perfumery. The agro-technology developed by CIMAP is an improvement over the existing one as it gives higher yields of the oil. Vetiver grown in light soils requires only 2-3 irrigations during summer.

COST Approximately Rs. 16,000 to Rs. 18,000 at the current price of the oil (1985) on good fertile soils.

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CULTIVATION OF JAVA CITRONELLA

JAVA CITRONELLA: CULTIVATION AND DISTILLATION

Java citronella is the best source of citronella oil - a raw material for production of geraniol, citronellol, hydroxycitronellol and other similar high-value perfumery bases. Citronella oil is widely used as a starting material for various aromatic chemicals in scented soaps, sprays, deodorants, detergents, polishes and in mosquito-repellent creams. Till recently, bulk quantities of the oil used to be imported and the State Trading Corporation estimated its demand in 1971 at 500 tonnes a year. The present estimates indicate that its demand is more than 1000 tonnes a year. The efforts of the Regional Research Laboratory (RRL), Jorhat, has helped to make the country not only self-sufficient in meeting indigenous demand but also meeting export demand.

It is an agro-technology. The plant could be cultivated in wastelands also. The cultivation and processing offer gainful employment. Grass left after distillation may be used for mulching. Spent-up grass can be pulped and used to manufacture paper boards.

COST A single farmer can earn Rs 1500 a month from one hectare of citronella crop by way of selling the grass to the distillation unit @ 50 paise a kg.

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Cultivation of mushroom

MUSHROOM CULTIVATION

Mushrooms grow abundantly on decaying tissues of succulent plant materials under normal conditions. Mushrooms are light grey in colour and have a mild flavour. Studies at the Central Food Technological Research Institute (CFTRI), Mysore, have shown that mushrooms can be cultivated easily under normal conditions of temperature (21-28 degree C) and relative humidity (55-75%) for a period of 6-8 months in a year. They can also be cultivated in summer months by providing extra humidity.

The technique can provide gainful employment to women and weaker sections of society. Taken with food, mushrooms can remove protein deficiency. Mushrooms can be cultivated on a wide variety of inexpensive substrates such as cereal straw, sawdust and cotton wastes. Investment cost is very low.

COST Mushroom cultivation can be taken up in the backyard of homes. The capital needed would be as low as Rs. 5,000.

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MUSHROOM (DHINGRI) CULTIVATION

Dhingri is a highly edible mushroom relished by people of all walks of life. It grows wild extensively in Jammu & Kashmir. The Regional Research Laboratory, Jammu, took the initiative to raise this crop artificially by farming on scientific lines. The method consists in cutting paddy straw into pieces, 10-12 cm long, and soaking them in water for 36-48 h after which the straw is removed and properly drained. The straw is then put in polythene bags (3 kg/bag). After incubating the bags in a room, the mycelium is inoculated and the bags are kept in a room with proper aeration. The blocks are regularly irrigated and the mushrooms start appearing after 4 to 5 days.

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B. IMPLEMENTS AND AIDS FOR USE IN AGRICULTURAL SECTOR

BULLOCK-DRAWN AUTOMATIC SUGARCANE PLANTER

Sugarcane planting is a labour-intensive operation. On an average, it requires 17 man-days and 2 pairs of bullocks to plant one hectare with the conventional '*desi*' plough. A bullock-drawn planter has been designed and developed, which carries out all the operations automatically. It consists of a frame-work on which are provided a drive system, a seed box, a metering system, a fertilizer, a seed box, an insecticide container, a furrow opening shovel, and a seed chute. The drive system consists of gears and chain-sprockets and separate levers for engaging and dis-engaging the drive. Arrangements are made for lowering and lifting the depth of planting. On an average, 100 m row is covered within 2 minutes. All the planting operations are accomplished in a single pass. The fully automatic bullock - drawn sugarcane planter greatly facilitates planting of sugarcane. On an average, an output of 1.25-1.5 ha/day is achieved with reduced labour requirement and at about 1/5th the cost that the conventional system would entail.

COST Rs 500.

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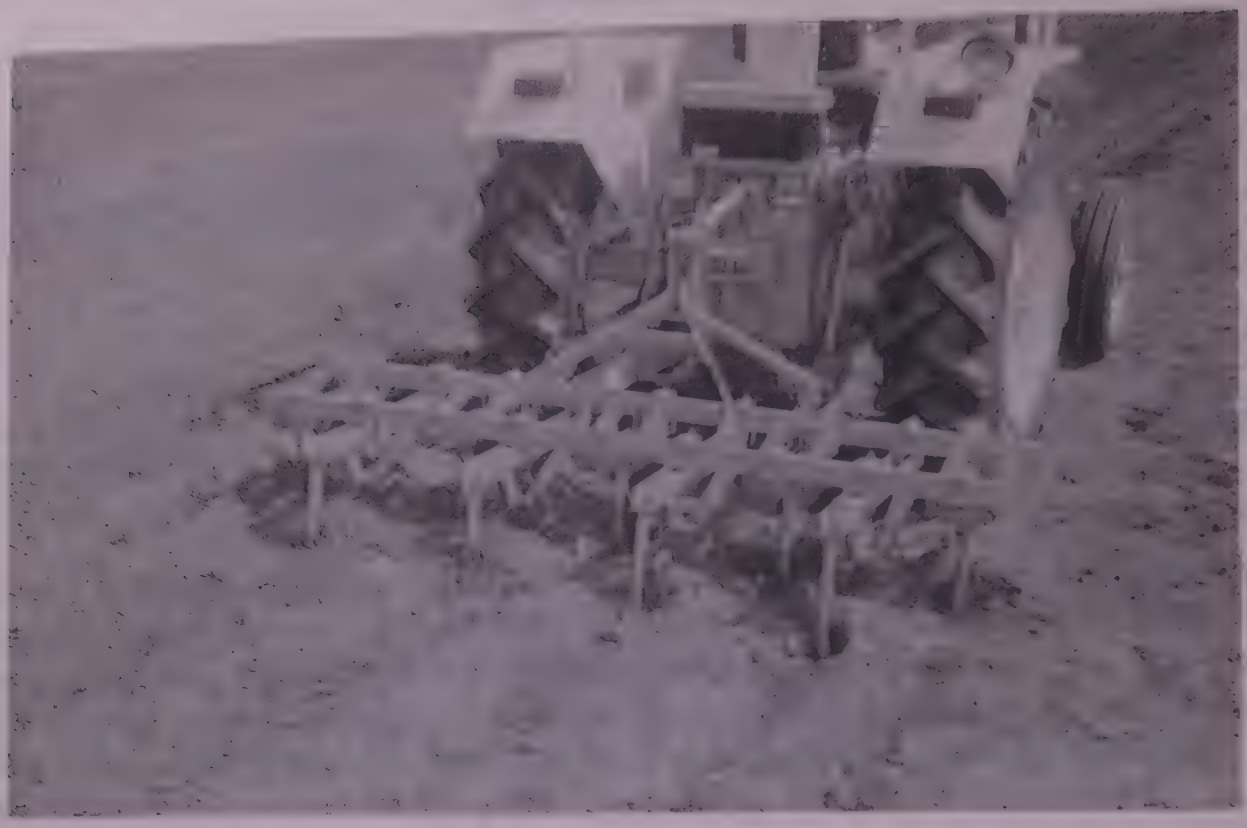

CULTIVATOR

CULTIVATOR

Swaraj cultivator is a multi-purpose implement for plowing, cultivating, scarifying and pasture renovating. High-field output saves fuel. Heavy-duty spring-loaded tines mounted on a sturdy steel frame provide excellent trash clearance with deeper penetration. Constant tine vibrations shatter the sub-soil to let roots and moisture penetrate deep into it. It has optional groundwheels to control tilling depth when used with tractors without depth-control hydraulics.

CONTACT AGENCY

Punjab Tractors Ltd.
S.A.S. Nagar 160 055
(Near Chandigarh) India
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DISC PLOUGH

DISC PLOUGH

This is a rugged and sturdy Swaraj disc plough, a versatile implement totally suited for tough soil conditions. Heat treated steel discs are mounted on double heavy duty precision taper roller bearings. A choice of three working angles for the disc and lateral shift on cross shaft enables optimum setting under extreme conditions. Individual disc scrapers are adjustable to meet any soil condition and ensure proper trash coverage. Working depth is controlled by tractor hydraulics.

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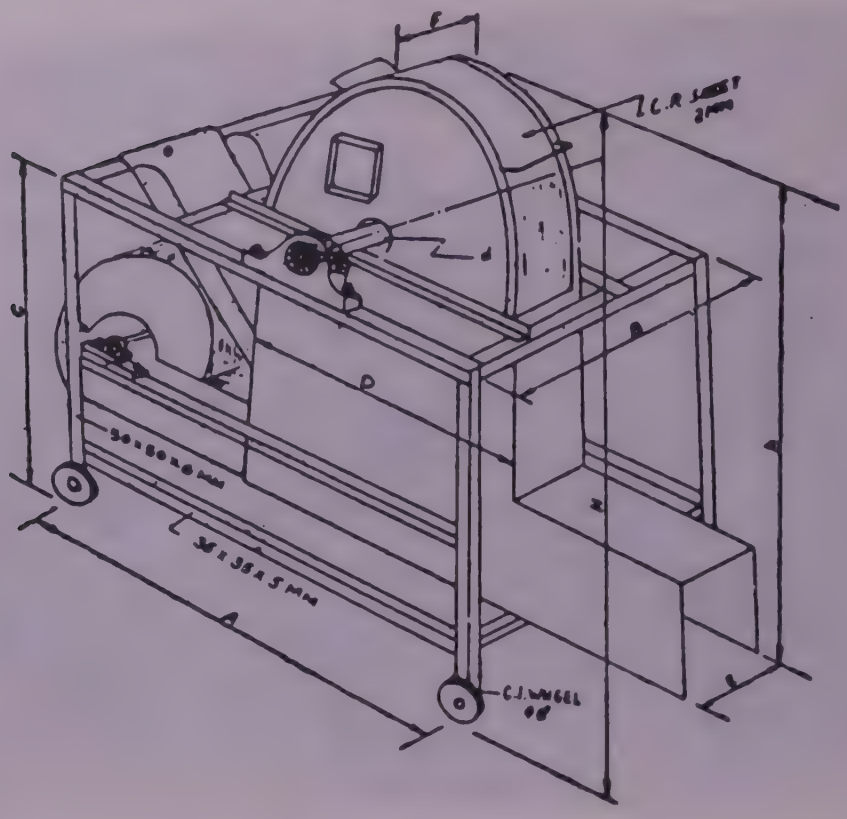

DRUMMY THRESHER

DRUMMY THRESHER

The thresher is mounted on a cage-like angle-iron frame supported on four strong legs. Small wheels, four in all, are provided for easy transportation. It can be operated by a diesel engine, an electric motor or a tractor. The advantage of this thresher is that chances of accident are less. The size of straw sticks can be regulated as needed. The other advantages of the drummy thresher are that it can be transported easily and also maintained and repaired easily. Grains, free from straw and foreign materials, can be obtained with the bagging-type thresher. It requires minimum repair, maintenance and care.

COST Rs. 2615 for 2 feet dia drum.

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FIVE-ROW MANUAL RICE TRANSPLANTER

In rice fields it is a common sight to find men and women transplanting saplings in a laborious manner. The conventional method of transplantation is time-consuming and the output is very little. A simple manually-operated rice-planting machine has been developed to save labour and reduce drudgery. It enables transplantation of rice saplings in a systematic manner and also increases productivity.

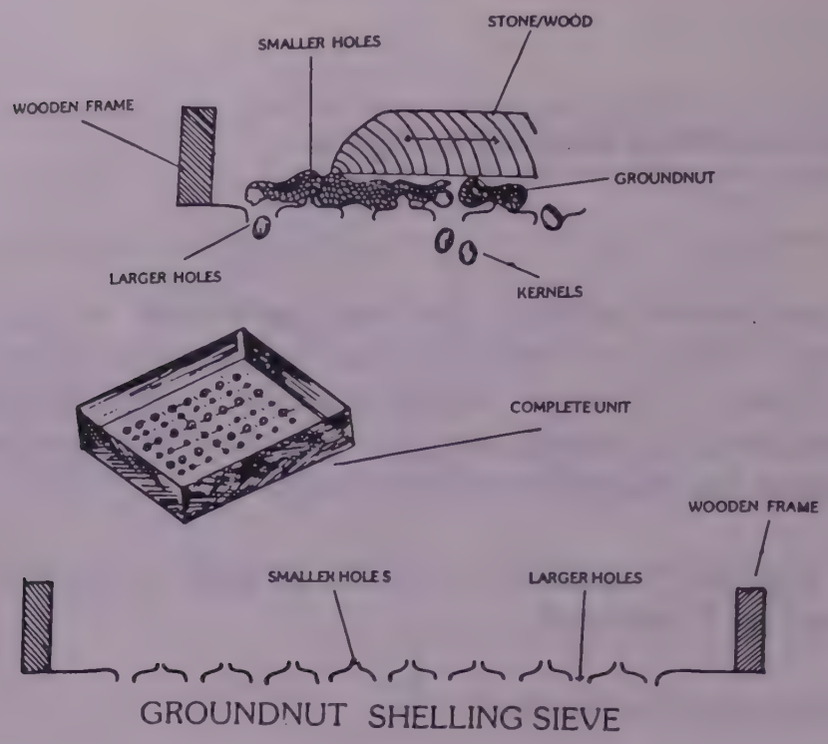
The machine is operated by moving its handle forward and backward, transplanting the seedlings in multiples of five rows.

The salient features of the machine are:

Working capacity : 0.1-0.2 ha/day, Weight : 25 kg, Operation technique : Simple and easy, requires only a little training to operate, Type of seedlings : Mat type, Seed rate : 35-40 kg/ha, Saving of labour : 150 labourers/h/ha

CONTACT AGENCY

The Managing Director
National Research Development Corporation
'Anusandhan Vikas'
20-22, Zamroodpur Community Centre
Kailash Colony Extension
New Delhi 110 048.



GROUNDNUT SHELLING SIEVE

GROUNDNUT SHELLING

Manual shelling of groundnuts is laborious and inefficient. A simple groundnut shelling sieve can be fabricated to reduce the drudgery and improve efficiency. The sieve is made from an iron sheet of 2 ft x 3ft in size. Holes not more than 1/2 inch diameter are made over the sheet in rows except for a strip of 2 inches wide around the edges. The holes are made by hammering from one side, using the sharp end of a bicycle-pedal spindle. Then the sheet is turned over and smaller holes are made using a 3 inch nail in the space between the holes already made. Now the iron sheet is fitted into a wooden frame so that the sheet forms the bottom of the sieve. It should be ensured that the sharp edges of the smaller holes point upwards. A handful of groundnuts is charged in the sieve and rubbed back and forth using a flat-bottomed stone or wood. The protruding sharp edges strip the shells off the groundnuts and the kernels fall through the larger holes into a container placed below the sieve.

COST Nominal. Skills and materials are available in villages.

CONTACT AGENCY

The Director General
Council for Advancement of People's
Action and Rural Technology
Guru Nanak Foundation Building
New Mehrauli Road
New Delhi 110 067

HAND-ACTUATED SEED METER

The traditional method of drilling seeds behind a bullock- operated plough requires considerable human skill and experience to achieve even seed distribution over the entire field.

The hand-actuated seed metering device can be effectively used to overcome the problems of the traditional method. Even an inexperienced person can use it for drilling seeds with uniform distribution. The device consists of a square-section mild steel pipe, fitted with a spring-loaded lever and a gate to regulate the flow of grain. The seed inlet end is made round in section to facilitate fitting of a flexible PVC tube. The cloth bag filled with seeds and carried on the operator's back is connected with the device by means of a PVC tube. The device is held in one hand while the seed bag is carried on the back. Seed metering is done by depressing the lever approximately once every second, while the person walks along with the plough at a normal speed. The seed rate can be adjusted by changing the stroke length of the lever. A screw is provided to adjust the lever stroke. The greater the stroke length the faster would be the seed distribution rate. The device has been tested with wheat. It can be fabricated by village artisans.

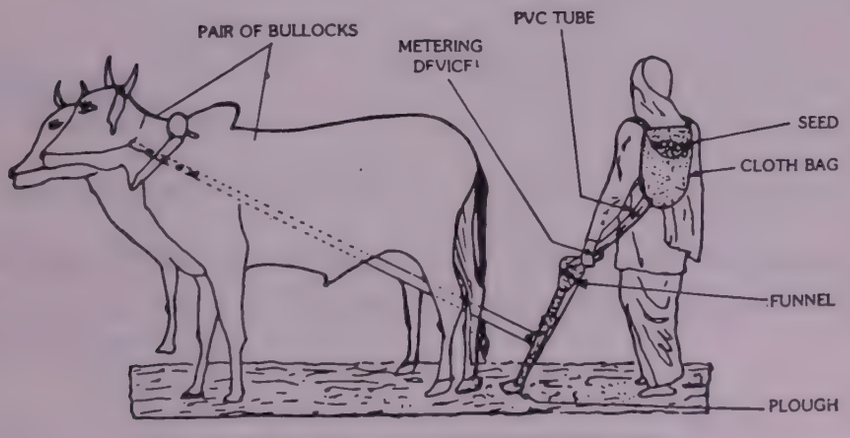


FIG. 1 OPERATION OF HAND ACTUATED SEED METER IN FIELD

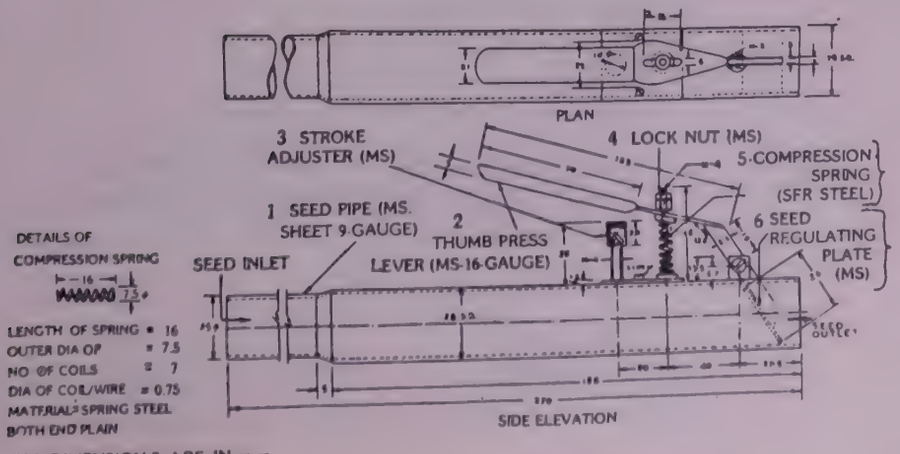
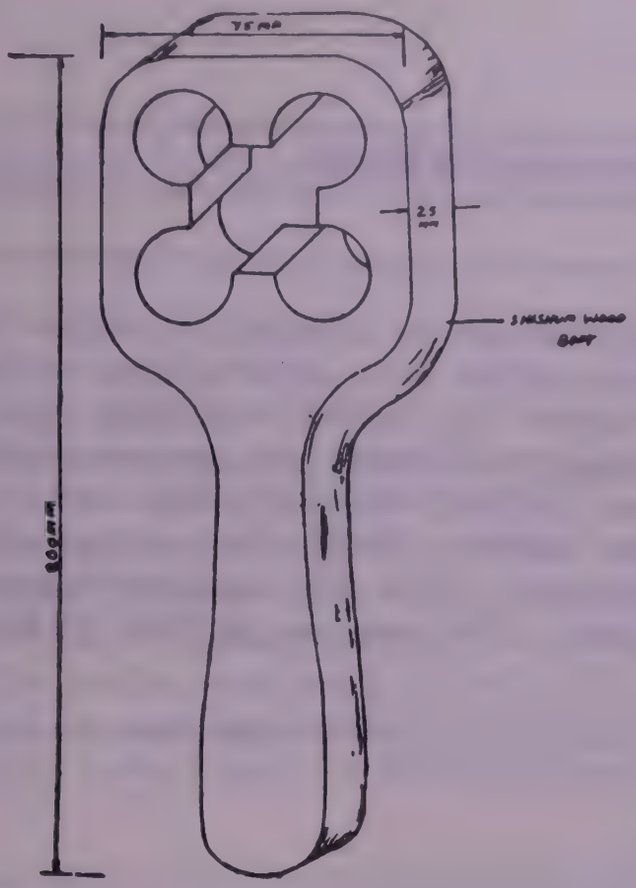

PLAN
3 STROKE ADJUSTER (MS)
4 LOCK NUT (MS)
5 COMPRESSION SPRING (SFR STEEL)
1 SEED PIPE (MS. SHEET 9 GAUGE)
2 THUMB PRESS LEVER (MS 16 GAUGE)
6 SEED REGULATING PLATE (MS)
SEED INLET
SEED OUTLET
DETAILS OF COMPRESSION SPRING
LENGTH OF SPRING = 16
OUTER DIA OF = 7.5
NO OF COILS = 7
DIA OF COIL WIRE = 0.75
MATERIAL SPRING STEEL
BOTH END PLAIN
SIDE ELEVATION
ALL DIMENSIONS ARE IN m.m.

FIG. 2 DETAILS OF SEED METERING DEVICE

COST The device with cloth bag is estimated to cost about Rs. 35 when made as a single unit locally.

CONTACT AGENCY

Shri N.P.S. Sirohi
Division of Agricultural Engineering
Indian Agricultural Research Institute
New Delhi 110 012.



121 HAND-MAIZE SHELLER

HAND-MAIZE SHELLER

Used for hand-shelling of grains from maize. It has high output of maize grain as compared to removal of grains by palms. It is hygienic and convenient method of maize-shelling and has anticipated life for three years.

COST Rs. 12 per piece.

CONTACT AGENCY

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Institute of Engineering and Rural Technology,
26, Chatham Lines,
Allahabad 211 002

Telephone	Telex	Telegram
55526, 53792	540-260 IERT IN	APOLY, Allahabad.

HAND-OPERATED DIAPHRAGM PUMP

In India small farmers have to work laboriously to irrigate their fields by lifting water manually from irrigation ditches, open channels, rivers and shallow wells. They cannot afford to use powered pumps. To facilitate water lifting from shallow water sources, a simple, low-cost, foot-operated diaphragm pump has been developed, which is well suited for low-lift irrigation. The pump consists of a light sheet metal cylinder with a central partition to provide two chambers. Rubber flap valves are used at the intake and exhaust ports. Two rubber diaphragms, made from an automobile inner tube, are so mounted that they can be easily replaced. The pump can lift 90 to 100 litres of water per minute to a height of 1-2 metres.

CONTACT AGENCY

The Managing Director
National Research Development Corporation
'Anusandhan Vikas'
20-22, Zamroodpur Community Centre
Kailash Colony Extension
New Delhi 110 048.

HAND-OPERATED KNAPSACK-TYPE INSECTICIDE SPRAYER

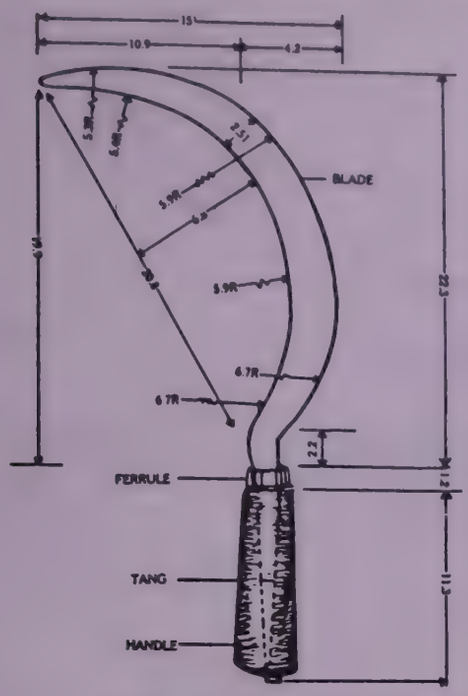
A hand-operated knapsack-type insecticide sprayer has been designed and developed by the Mechanical Engineering Research and Development Organization (MERADO), Ludhiana. The sprayer consists of a tank in which the spray liquid is carried; a piston-type pump which delivers the liquid from the tank to the nozzle at a required pressure; an air pressure chamber which makes the liquid flow continuously; and a nozzle which determines the spray pattern and range of spray droplet sizes. The cut-off device fitted in the discharge line controls the flow of the spray to the nozzle. A part of the spray liquid under pressure is fed to the tank for agitating agro-chemicals. The chemical to be sprayed is stored in the tank and the sprayer is strapped to the back of the operator. The pump is operated with one hand and the cut-off device along with spray-lance and nozzle is held in the other hand. The operator moves forward and directs the flow of the spray liquid to the target.

Hand-operated knapsack-type insecticide sprayer

COST Rs 400.

CONTACT AGENCY

Sigma Steel Industries
A-2, Industrial Estate
Ludhiana 141 003 (Punjab)



IMPROVED SICKLE

IMPROVED SICKLE

Sickles of various types and shapes are being used by farmers for cutting crops. The efficiency of a sickle depends mainly on the shape of the blade, the material used for making the blade, the length of handle and the type of grip. A crescent-shaped blade with a short cranked handle is suitable for a semi-circular cutting motion, while a straight blade fastened almost at a right angle to the handle (which is long and sometimes slightly covered at the end to give a better pull) is suitable for pulling out.

A sickle with improved performance has been developed. The salient features of the sickle are: It has a high capacity (100-125 man-hours/ha); helps in close cutting of crops (resulting in extra amount of straw); has balanced design and is light-weight. It does not require frequent sharpening and has replaceable serrated blade.

CONTACT AGENCY

The Managing Director
National Research Development Corporation
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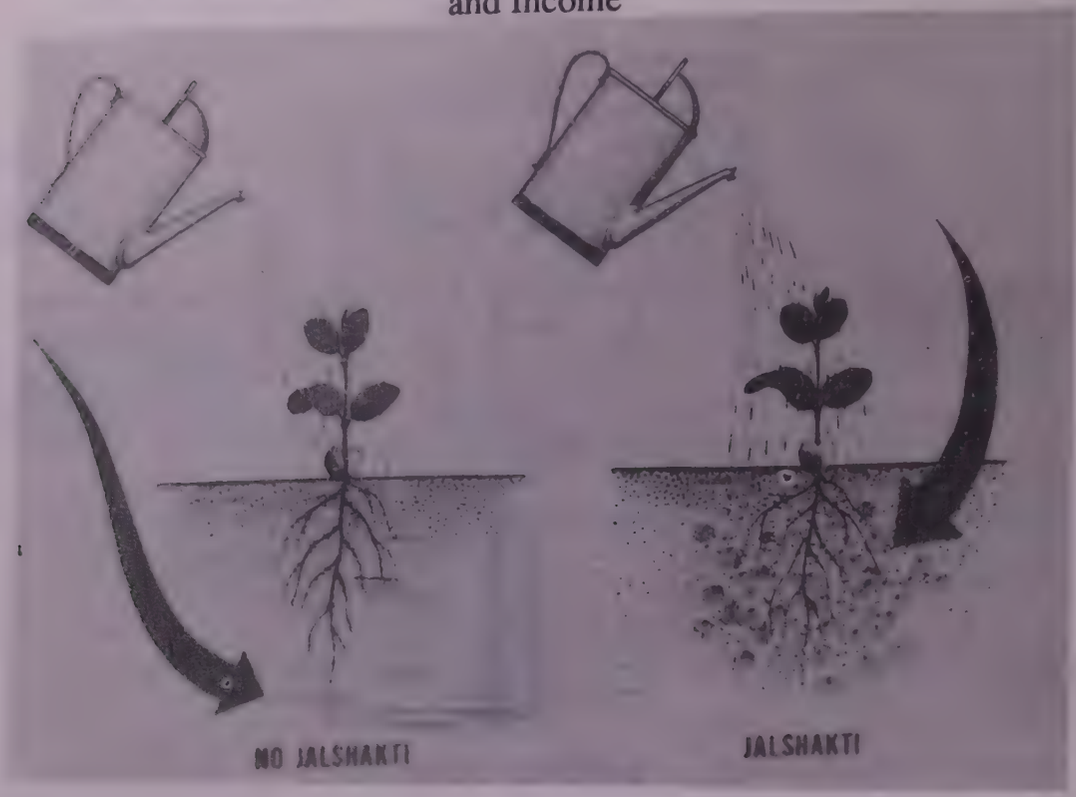
Kailash Colony Extension
New Delhi 110 048.



JALSHAKTI

Jalshakti is a granular organic superabsorbent product especially designed to improve plant-water relationship. When mixed with soil, sand or any synthetic growing medium, *Jalshakti* increases both its water retention capacity and aeration, thus improving the soil quality; it also helps in reducing the frequency of irrigation. By proper application, *Jalshakti* can help protect plants against water stress, and by improving aeration of the growing media it can aid in producing plants with healthier systems. *Jalshakti* is an off-white free-flowing powder. Its water absorption capacity decreases in the presence of salts and is independent of temperature in the range 20 - 70 degree C. The product is quite hygroscopic but retains its free flowing character even at 50% water absorption. The major use of *Jalshakti* is expected to be in agriculture as soil amendment when mixed with soil, and as seed - coating at the time of planting. It can also be used as a soil reclaiming agent in arid lands.

COST The application of *Jalshakti* has given an increase in yield of 17-42% over the untreated plots, corresponding to an additional income of about Rs 1000-4000 per hectare after taking into account the cost of application.

CONTACT AGENCY

The Director
National Chemical Laboratory
Pune 411 008,
India

Telephone	Telex	Telegram
336151	0145-266 NCL IN	CHEMISTRY, Pune

LOW-LIFT PUMP

Low-lift pump is human-operated and is a reciprocating-type water lifting pump. This pump has been developed by modification of the hand pump. It is useful for minor irrigation and is easy in operation. Low-lift pump is commonly used for lifting water from canals, tanks, rivers etc. It can irrigate about 1/6 acre land in 12 hours.

COST Rs. 2000.

CONTACT AGENCY

The Principal
M.P. Polytechnic Gorakhpur
P.O. Lachchipur
Gorakhpur (U.P.)

MULTI-CROP PLANTER

MULTI-CROP PLANTER

This multi-crop planter is a versatile implement and suitable for different row-spacing. Its construction and tool bar mountings give it the freedom to change row-spacing or increase planting area. The four-bar linkage arrangement ensures a uniform depth of seeds in uneven fields. A spring-loaded cut-off pawl pushes extra grains as the cell passes under it. The furrow-opener continuously distributes fertilizer on both sides of the seed, so young roots find nourishment early. The knock-out pawl drops the seed from the cell into the seed guide accurately, thus eliminating any chances of the seed missing the appropriate spot. The large drive wheel for positive drive makes for minimum misses. The unit is thus highly efficient.

CONTACT AGENCY

Punjab Tractors Ltd.
S.A.S. Nagar 160 055
(Near Chandigarh) India
Telex
0395-222, 0395-377, 0395-381

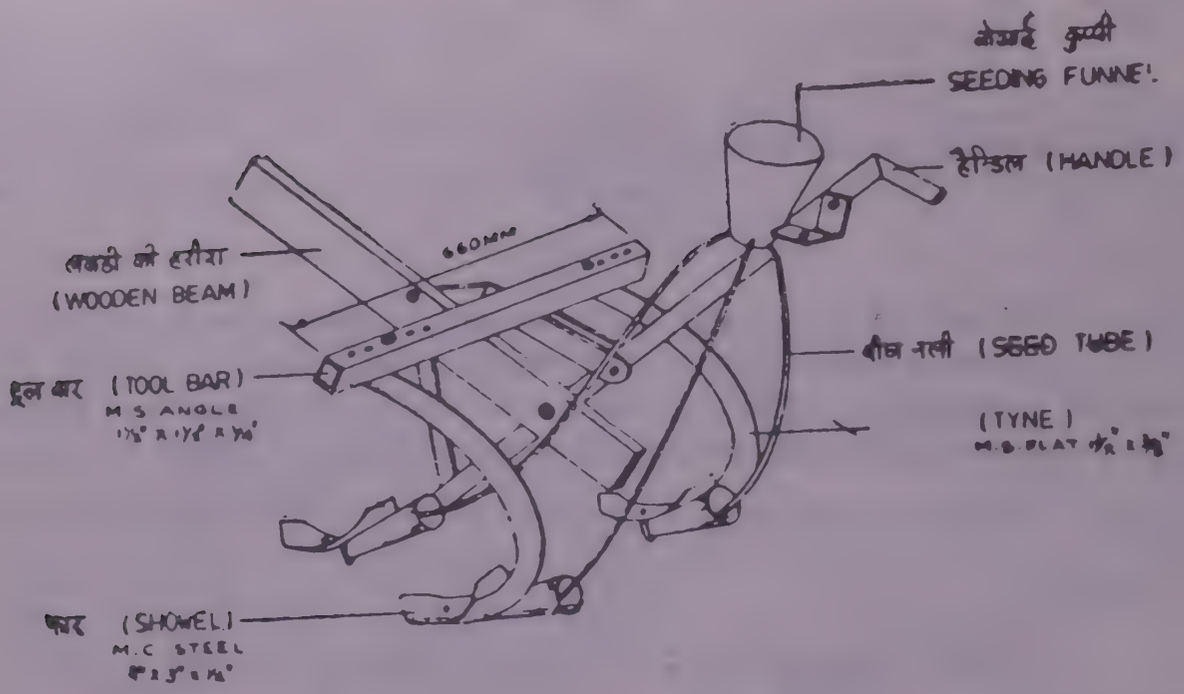
THE ELECTRONIC RODENT KILLER

The electronic rodent killer is a special, totally automatic machine which attracts rats, kills instantly and disposes of immediately. It is the first of its kind developed anywhere and the interest shown by the farmers in this machine is unbelievable. It works with 12 V battery. If the device is used on a large scale, several lakh tonnes of foodgrains can be saved annually.

CONTACT AGENCY

The Director
Central Electronics Engineering Research Institute
Pilani 333 031

Telephone	Telex	Telegram
11	031-4171	ELECTRONIC, Pilani



THREE TYRE CULTIVATOR

THREE-TYNE CULTIVATOR

The implement consists of three tynes with an iron showel mounted on angle iron tool-bar, which performs shallow ploughing and interculture operations. It has a capacity of 0.75 to 1.0 ha/day and is based on bullock speed of 2.5 km/h. It performs ploughing and interculture operations in three rows at a time. Row-to-row spacing can be adjusted. When the showels from one side wear out, it can be used from the other side. Performs sowing of seeds and fertilizers in rows with seeding attachment.

COST Rs 206.00 for a three - tyne cultivator. Rs 275.00 for a cultivator with seeding attachment.

CONTACT AGENCY

Centre for Development of Rural Technology
Institute of Engineering and Rural Technology
26, Chatham Lines,
Allahabad 211 002

Telephone	Telex	Telegram
55526	540-260 IERT-IN	APOLY, Allahabad

TRACTOR

TRACTORS AND COMBINE HARVESTOR

Various models of tractors and combine harvestors have been designed and built by M/S Punjab Tractors Ltd to suit different conditions in farming activities. Some of the machinery and equipment are:

A. *SWARAJ - 735 TRACTOR*

39 H.P., 3 cylinder, water - cooled diesel engine with automatic draft and depth control hydraulic system.

Max. forward road speed 24.5 km/hr and reverse speed 10 km/hr, pulling 9 tyne cultivator, 6 x6 trailing disc harrow and 2 furrow M.B./Disc Plough.

Water - proof disc brakes best suited for paddy cultivation.

B. *SWARAJ - 724 TRACTOR*

26.5 H.P., 2 cylinder, water - cooled diesel engine with automatic draft and depth control hydraulic system.

Max. forward road speed 24.5 km/hr and reverse speed 10 km/hr, pulling 9 tyne cultivator, 6 x 6 trailing disc harrow and 2 furrow M.B./Disc Plough.

HARVESTOR COMBINE

Water - proof disc brakes and most economical tractor in 2 - cylinder range tractors.

C. *SWARAJ - 720 TRACTOR*

19.5 H.P., single cylinder, water - cooled diesel engine.

Available in handle start and electrical start with mechanical and automatic hydraulic system.

India's cheapest and most economical tractor for small farmers.

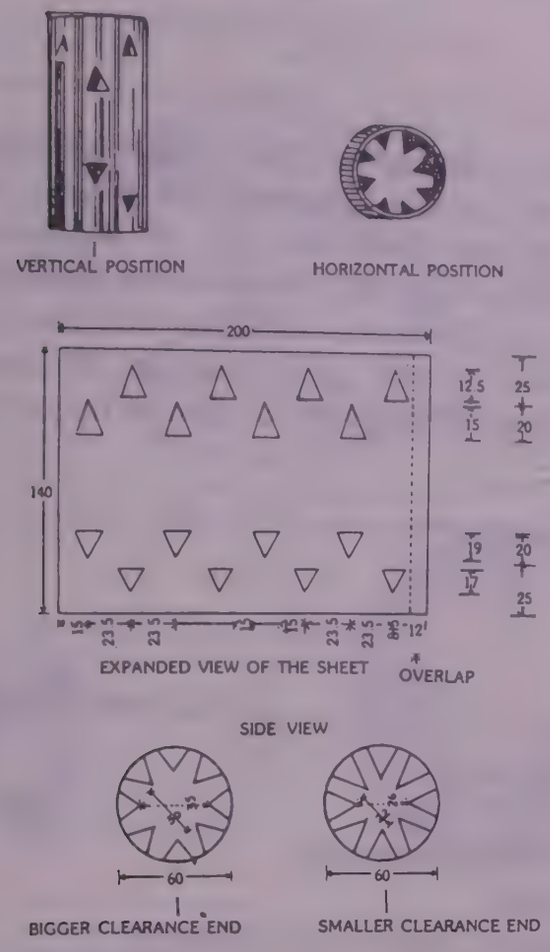
D. *COMBINE HARVESTER (SELF - PROPELLED)*

105 H.P. engine (Leyland) with 14' cutter bar.

Suitable for harvesting paddy, wheat, soyabean, sunflower, etc.

CONTACT AGENCY

Punjab Tractors Ltd.
S.A.S. Nagar 160 055
(Near Chandigarh) India
Telex
0395-222, 0395-377, 0395-381



TUBULAR MAIZE SHELLERS
RAU MODEL

TUBULAR MAIZE SHELLERS

Metal Maize Sheller (RAU Model)

This maize sheller is made of 20 gauge GI sheet of 20 cm x 14 cm size, folded into a cylindrical shape of 6 cm diameter and 14 cm length. The joining ends are fixed together with the help of two rivets. Four rows of V-shaped notches with four notches in each row are cut at both ends of the pipe. All the notches are inverted inside the pipe at an angle of 90 degrees. The length of the notches should be 12.5 mm, 15.0 mm, 17.0 mm and 19.0 mm for the first, second, fourth and third rows respectively. The differences in the length of the notches make the device suitable for various sizes of maize cobs. One end of the sheller is suitable for bigger diameter cobs and the other end for small diameter cobs. The sharp edges of the pipe ends are folded to ensure safety for the user.

The cob is firmly inserted into one end of the pipe. The sheller is now rotated half a circle with one hand and the cob in the opposite direction with the other hand and then back to the original position. The same process is repeated till all the kernels are removed. First, about two-thirds of the cob should be shelled, then reversed and the process repeated to shell the remaining portion. It should be kept in mind that very little force is required to insert the cob inside the maize sheller to avoid grain damage. This maize sheller is two and a half times more efficient than hand shelling and can give an output of 15 kg of shelled grains per hour.

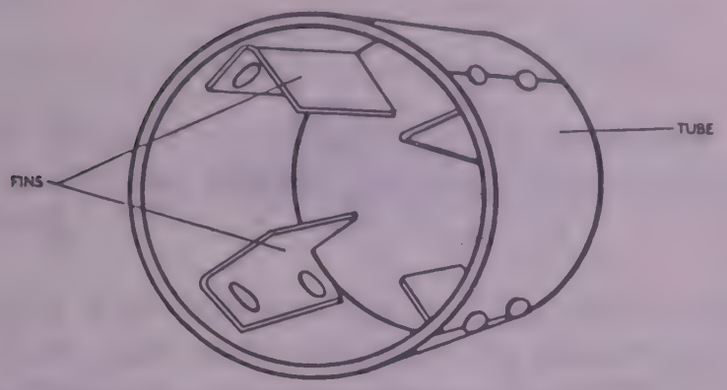
COST Rs. 5.

CONTACT AGENCY

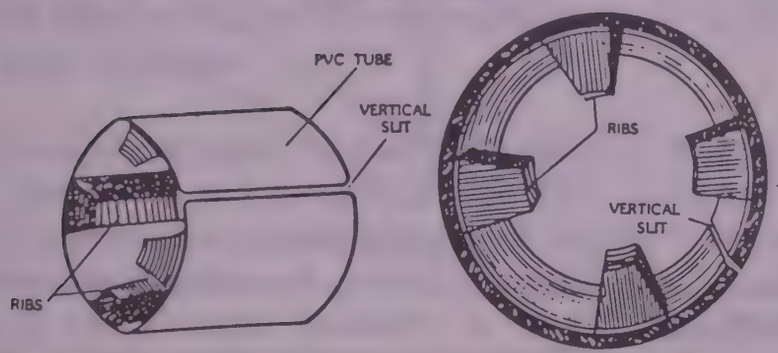
Shri J.P. Gupta, Shri. R.P. Singh,
Shri. J. Sahay and Shri. C.N. Roy,
Department of Agricultural Engineering
Bihar Agricultural College
Sabour Campus of Rajendra Agricultural University
Pusa - Samastipur
Bihar

TUBULAR MAIZE SHELLERS

CIAE MODEL



PVC TUBE MAIZE SHELLER



SIDE VIEW SHOWING VERTICAL SLIT

FRONT VIEW

Metal Maize Sheller (CIAE Model)

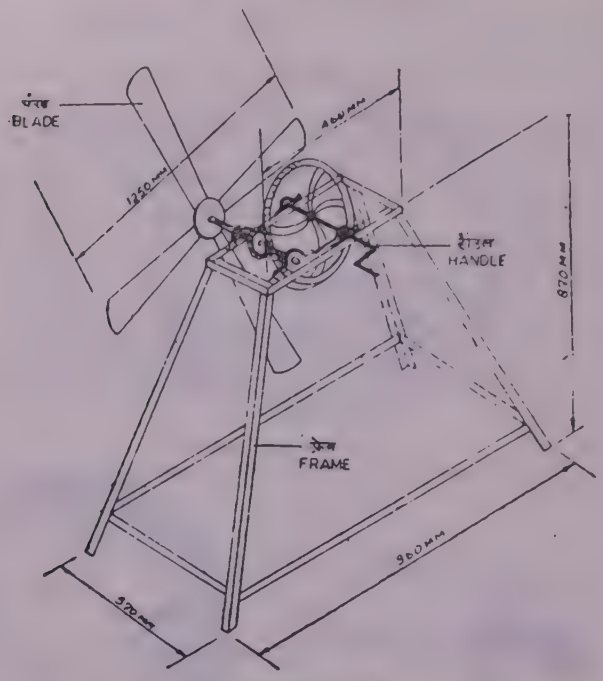
This sheller is made from a short length of 62.5 mm diameter MS pipe of 16 SWG. Four fins are made from an 18 gauge MS sheet and bent at 70 degrees. The fins are tapered and fitted inside the tube. The tapered ends of the fins provide two variable openings, 39 mm on one side and 26.5 mm on the other. This arrangement helps to handle cobs of different sizes.

The sheller is held in the left hand and the maize cob is inserted by right hand. These are then rotated in opposite directions. The fins remove the kernel from the cob. 15-23 kg of kernel can be sheeled in an hour with an efficiency of more than 99 per cent.

COST Rs. 8 a piece.

CONTACT AGENCY

Central Institute of Agriculture Engineering (ICAR)
Shri Guru Tegh Bahadur Complex
T.T. Nagar, Bhopal 462 003
Madhya Pradesh



WINNOWING FAN

WINNOWING (OSAI) FAN

Much of the agricultural labour is spent in cleaning the grains contaminated with various foreign matter. Paddy husking and cereal processing form an important part of women's work. The winnowing (OSAI) fan can reduce the drudgery in this work. It comprises a suitable gear arrangement coupled to a set of blades for generating air, which can be rotated with the help of a handle. The gear assembly is operated by a handle provided at one end of the axle of the big gear and a fan is attached to the axle of the small gear. The whole unit is fixed on a rectangular angle iron frame which is supported by four legs and braces of angle iron. It has a capacity of 30 kg grain/hour. The fan speed can be increased by increasing the gear ratio. Less power is needed because of the ball bearings. It can be easily transported. Repair and maintenance is possible at village level.

COST (i) Winnowing fan without safety cover Rs. 700 (ii) Winnowing fan with safety cover Rs. 850.

CONTACT AGENCY

Centre for Development of Rural Technology
Institute of Engineering and Rural Technology
26, Chatham Lines
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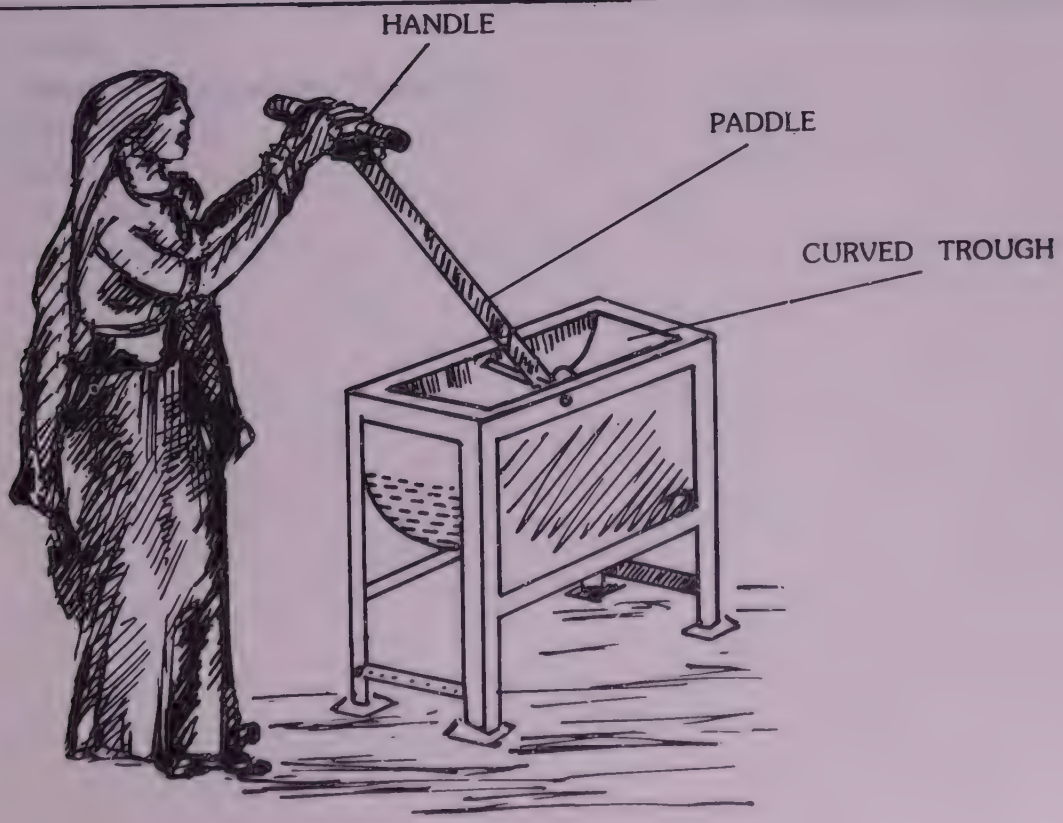
GROUNDNUT SHELLER

The sheller reduces the drudgery of manual shelling of groundnuts. It does not need any skill to operate (even children can operate it as a game!) and with proper maintenance it can serve for several years.

The sheller consists of a semi-cylindrical trough. The curved bottom of the trough is made from a rigid 1.25 cm square width weld mesh or a sieve. An axle pipe is fixed in the centre. A paddle is attached to this so that it can be rotated throughout the entire curvature of the trough. The paddle has an adjustable arrangement for a blade which can be raised or lowered in relation to the wire mesh.

A handful of groundnuts is charged in to the sheller. The blade of the pedal can be so adjusted that it crushes only the shells and released kernels slip out of the wire gauge and fall below the trough. Groundnuts are fed and the paddle is rotated sideways at the same time. To get optimum results, little quantities of groundnuts should be fed into the sheller in a slow but continuous manner. Decortication efficiency is 99-100 per cent and the broken percentage is just 1-3.

A single person can shell 60-70 kg of pods in an hour by using this sheller.



OPERATING A GROUNDNUT SHELLER

COST Rs. 250 for one sheller.

CONTACT AGENCY

Central Institute of Agricultural Engineering (ICAR)
Shri Guru Tegh Bahadur Complex
T.T. Nagar
Bhopal 462 003
Madhya Pradesh.

C. IMPROVED PRACTICES FOR AGRICULTURE

RATOON MANAGEMENT TECHNOLOGY

Sugarcane obtained from the ratoon is more economical than the plant cane. It saves the production cost in terms of field preparation, preplanting, irrigation and seed materials. However, the yields obtained at farmers fields are lower than in the plant cane. The reason is that the farmers pay less attention to ratoon cultivation. To aid the farmers, the Indian Institute of Sugarcane Research, Lucknow, has developed the technologies, viz. selection of improved and high tillering varieties, trash-burning, gap-filling, off-barring, balanced fertilizer application, irrigations at critical growth periods, cultural operations, earthing up, wrapping and tying.

CONTACT AGENCY

The Director
Indian Institute of Sugarcane Research,
Post Office:Dilkusha
Rae Bareilly Road
Lucknow 226 002

INTER - CROPPING

The initial growth of sugarcane is very slow in autumn and spring - planted crops. Hence the space between two rows of sugarcane may be utilised for growing suitable intercrops. In autumn - planted sugarcane, growing of potato, wheat, mustard, coriander and garlic crops are economical. Moong and urd crops could be grown as intercrops with spring-planted sugarcane. Additional net profit of Rs. 5000 to Rs. 7000/ha for autumn-planted and of Rs. 2000 to Rs. 2500/ha from spring-planted sugarcane are obtained.

CONTACT AGENCY

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Indian Institute of Sugarcane Research,
Post Office: Dilkusha
Rae Braielly Road
Lucknow 226 002

RING SYSTEM OF SUGARCANE CULTIVATION

To increase sugarcane production per unit area, a ring system has been evolved. In this system, 3 ft. diameter and 1 ft. deep circular pits are dug in the fields. The distance between the centres of two pits is kept at 4 ft. In each pit, 20 budded sets are arranged as spokes of the cycle. About 8-10 kg farm yard manure (FYM), 100 g. NPK and 50 g. urea are applied in each pit. In one hectare, 7000 pits are made. This system enhances the cane yields from 150 to 180 tonnes/ha.

CONTACT AGENCY

The Director
Indian Institute of Sugarcane Research,
Post Office: Dilkusha
Rae Bareilly Road
Lucknow 226 002

STRIP - FURROW IRRIGATION

Normally sugarcane requires 5 irrigations before the onset of monsoon. However, the water resources are not sufficient to provide recommended irrigations to sugarcane. Hence, the Indian Institute of Sugarcane Research has developed strip-furrow irrigation (trench formation) at alternate cane rows, which saves 36 per cent water as compared to flood method of irrigation. In addition, covering of trash mulch (4" cover) after the emergence of cane (40 to 45 days after planting) with 3 irrigations and 50 kg N/ha also produced yields at par with those of 5 irrigations with 150 kg N/ha.

CONTACT AGENCY

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Indian Institute of Sugarcane Research
Post Office:Dilkusha
Rae Bareilly Road
Lucknow (U.P.) 226 002

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